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IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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WANSON (M.) & HENRARD (C.). **Les simulies de Léopoldville : description d'espèces nouvelles.**—*E. Afr. med. J.* **21** no. 2 pp. 34–47, 2 pls., 20 refs. Nairobi, 1944.

Records are given of nine species of *Simulium* taken at Leopoldville in the Belgian Congo since 1938, with notes on their breeding places and on the morphology of most of them. *S. albivirgulatum*, sp. n., *S. wolfsi*, sp. n., and *S. griseicolle* vars. *dentulatum* and *trisphaerae*, n., are described. The females of *S. albivirgulatum* attack man, dogs, fowls and ducks. Two kinds of pupae of *S. alcocki*, Pomeroy, were found, the typical one and that described by Gibbins as *S. alcocki* var. *henrardi* [*R.A.E.*, B **30** 97]. The latter has been found in Portuguese East Africa by B. De Meillon.

CUNNINGHAM VAN SOMEREN (G. R.). **Napier Grass, *Pennisetum purpureum*, for consolidating River and Drain Banks in antimalarial Works.**—*E. Afr. med. J.* **21** no. 2 pp. 48–53. Nairobi, 1944.

The kinds of grasses that can be used for consolidating the banks of canalised rivers and the sides of drains made in the course of work against Anophelines are discussed, and notes are given on trials in Nairobi between 1938 and 1943 on the use of Napier grass (*Pennisetum purpureum*) for this purpose. It was of considerable value, as it consolidated the banks sufficiently for them to withstand severe flooding, and did not encourage undercutting. If planted carefully, it will grow in most types of soil, and at altitudes up to 7,000 ft. It has a good root system, will not enter the water, and grows rapidly and provides cuttings for further propagation, and also compost and fodder. The stems, if allowed to grow, produce shady conditions that are unsuitable for *Anopheles gambiae*, Giles, and probably do not favour *A. funestus*, Giles, and they can be used for fencing and hurdles. River banks must be well sloped when this grass is used, and the first row of grass must be at the base of the bank (dry season level) and the others staggered and about one foot apart with a foot between each plant.

VAUCEL (M.) & CAMPOURCY (A.). **L'anophélisme au Cameroun français.**—*Rev. Sci. méd. Afr. franç. libre* **2** no. 1 pp. 85–88. Brazzaville, 1943.

The species of *Anopheles* most frequently found in the French Cameroons in the course of more than three years were, in order of decreasing abundance, *A.*

gambiae, Giles, *A. funestus*, Giles, *A. pharoensis*, Theo. (which is limited to the savannah in the north) and *A. splendidus*, Koidz. [*sic? maculipalpis*, Giles]. Ten other species were taken, but none comprised more than one per cent. of the total. No appreciable seasonal variation in distribution was observed. During 1940 and 1941, 2,896 females of *A. gambiae*, 495 of *A. funestus* and 206 of *A. splendidus* from native villages were dissected at Yaunde and the total malaria infection rates found in the three species were 18·5, 10·7 and 10·7 per cent., respectively, and the sporozoite rates 14·3, 7·4 and 8 per cent. Single females of *A. obscurus*, Grünb., and *A. nili*, Theo., were dissected and were negative. In the first four months of 1942, 698 females of *A. gambiae* were examined, of which 26·6 per cent. were infected. No correlation was found between the sporozoite index and temperature or rainfall. Data are given showing a correlation between the sporozoite indices of females of *A. gambiae* taken in six native villages surrounding Yaunde in April 1942 and the gametocyte indices of the inhabitants at the same time. It was remarkable that in a small village housing native workers within the European town, with a higher standard of living than the other villages studied, the gametocyte index was much lower than any recorded elsewhere, although the sporozoite index was one of the highest. The very large numbers of breeding places of *A. gambiae* both along the edges of permanent streams and in flood water and rain pools make effective control measures impossible except in the towns.

WEATHERSBEE (A. A.). **Observations on the relative Attractiveness of Man and Horse for *Anopheles albimanus* Wiedemann.**—*Amer. J. trop. Med.* **24** no. 1 pp. 25–28, 8 refs. Baltimore, Md., 1944.

Details are given of observations made in March 1943 in eastern Porto Rico. Two Magoon-type traps [*R.A.E.*, B **23** 302] were set up about 100 ft. apart and 200 ft. from a landlocked fresh-water pond where *Anopheles albimanus*, Wied., was breeding abundantly. One was occupied on 20 nights by a man protected by mosquito netting and the other by a horse. Ten different men (six white, two mulatto and two negro) and six different horses were used. The total numbers of adults of *A. albimanus* attracted to man and horse were 123 and 2,791, respectively. Sometimes, no mosquitos went to the human bait and excluding the last few nights when numbers were too small to be significant owing to the admission of the sea-water into the pond [*cf.* **32** 128], the highest percentage of the total ever taken in the man trap was 11. The difference in attractiveness of individual men, which was not related to race or colour, appeared to be far greater than that of individual horses. Horses are, therefore, considered likely to be more satisfactory than man for use as bait to measure the density of the species in an area. There did not appear to be any definite factor, such as colour, to account for the differences that did exist in the attractiveness of individual horses.

LEVÍ CASTILLO (R.). **The possible Role of *Chara fragilis* in Mosquito Control.**—*Science* (N.S.) **100** no. 2595 p. 266, 3 refs. Lancaster, Pa., 1944.

In view of divergent opinions as to the effect of *Chara* on the development of mosquito larvae [*R.A.E.*, B **16** 141, etc.], the author tested the action of *Chara fragilis* on *Culex fatigans*, Wied., *Aëdes aegypti*, L., *A. euplocamus*, D. & K., *Anopheles albimanus*, Wied., and *A. pseudopunctipennis*, Theo., in Ecuador. The eggs of each species hatched, and the larvae developed normally, in an aquarium in which *C. fragilis* was growing, in an infusion of *Chara* and in a water extract of its fresh stems, and the larvae developed normally when fed in the first–fourth instars on oospores or rotted stems of the plant that were dried, crushed and mixed with yeast. Mosquito larvae were found in nature in pools in which *C. fragilis* was growing with other algae, and the larvae were observed to ingest small particles of *Chara*.

CALLOT (J.) & DAO-VAN-TY. **L'*Aëdes caspius* (Pallas) aux environs de Paris.**—*Bull. Soc. Path. exot.* **35** no. 9–10 pp. 326–327. Paris, 1942. [Recd. 1944.]

Aëdes caspius, Pall., which is characteristically a salt-water mosquito and is widely distributed along the coast of France, was found in an inland district in 1926. It is here recorded that one of the authors was attacked by females of this species in the afternoon in open country near Paris, and a search revealed immature stages in a pool formed by a drain in bad repair in a neighbouring sewage farm. Numerous similar breeding places and females were found in various parts of the farm.

SCHMIDT (E.). **Libellen als Objekte der angewandten Entomologie. Eine Literaturstudie.** [Dragonflies as Subjects of applied Entomology. A Review of the Literature.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1494–1505, 1 pl., 50 refs. Weimar, 1939. [Recd. 1944.]

It is concluded from this review of the world literature that dragonflies are harmful, since they destroy honey bees and small fish, particularly trout, and transmit Trematodes of the genus *Prosthogonimus* to fowls that feed on them [*cf. R.A.E.*, B **17** 224 ; **27** 247, etc.], but also beneficial, since they serve as food for fish, the nymphs destroy mosquito larvae [**9** 142, 202, etc.], and the adults are predacious on mosquitos [**3** 183, 184], Tabanids [**9** 14], tsetse flies (*Glossina*) [**9** 175 ; **24** 58] and apparently also some insect pests of plants.

Medizinische und veterinärmedizinische Entomologie. [Medical and Veterinary Entomology.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 1553–1733. Weimar, 1939. [Recd. 1944.]

The papers in this section [*cf.* also *R.A.E.*, B **27** 52 ; **28** 97], many of which contain information that has been noticed from other sources, include : **The distinguishing Characteristics of the Populations of *Anopheles maculipennis* found in southern Europe,** pp. 1555–1569, 3 figs., 15 refs., by M. BATES & L. W. HACKETT [*cf.* **29** 41] ; **Die Insekten als Gifttiere** [Insects as Poisonous Animals], pp. 1570–1578, in which F. ECKSTEIN discusses, partly from the literature, the composition and comparative toxicity of insect poisons, largely that of bees ; **The geographical Distribution of Mosquitoes in China,** pp. 1579–1588, 4 refs., in which Lan-chou FENG gives a list of the mosquitos of China [*cf.* **26** 223] and discusses the effect of temperature, rainfall, topography and special breeding habits on their distribution ; **Das Finlay-Institut und die Gelbfiebermücke** [The Finlay Institute and the Yellow Fever Mosquito], pp. 1589–1603, 1 pl., in which W. H. HOFFMANN reviews the history of the discovery that yellow fever is transmitted by *Aëdes aegypti*, L., describes the habits of this mosquito and refers to the danger of the introduction of infected females with modern means of transport into regions, such as the Far East, where the disease does not occur, and to the existence of jungle and rural yellow fever in the absence of *A. aegypti* in South America ; **Können die Fleischfliegen eine Myiasis intestinalis verursachen ?** [Can Blowflies cause intestinal Myiasis ?], pp. 1604–1607, in which J. KOMÁREK recapitulates experiments indicating that blowfly larvae cannot develop in the intestines of dogs and cats and hence are incapable of causing intestinal myiasis in man or animals [*cf.* **24** 305], a conclusion that was vigorously disputed in the discussion that followed ; **Die Kaltstellung der Plasmodien und die Durchmischung der Anophelen als Erklärungsprinzipien in der Malaria-Epidemiologie** [The Relation to Cold of *Plasmodium* and the Exchange of Anopheline Populations as leading Principles in the Epidemiology of Malaria], pp. 1608–1618, in which E. MARTINI reiterates his view that differences in the transmission of malaria by the varieties of *Anopheles maculipennis*, Mg., are due not to varying preferences for blood of man or domestic

animals, but to differing microclimatic requirements [*cf.* **21** 136; **23** 164]; **Fliegenlarven als fakultative Parasiten bei Menschen und Tieren in Norwegen** [Fly Larvae as facultative Parasites of Man and Animals in Norway], pp. 1641-1655, 3 pls., 31 refs., in which L. R. NATVIG shows from a review of the scattered literature that the fly chiefly responsible for cases of external myiasis of man and horses in Norway is *Hypoderma lineatum*, Vill., and mentions isolated cases of external myiasis of sheep due to *Lucilia*, intestinal myiasis of man caused by *Fannia scalaris*, F. [**20** 277] and intestinal myiasis due to *Eristalis* in a cow [**13** 58] and a horse; **Ueber einige Probleme der mechanischen Uebertragung von Krankheiten durch Insekten** [Some Problems of the mechanical Transmission of Diseases by Insects], pp. 1656–1662, by O. NIESCHULZ, which is a German version of a paper already noticed [**28** 179]; **Wirtsfindung und Wirtsspezifität von Flöhen** [Host Finding and Host Specificity of Fleas], pp. 1663–1668, 4 refs., in which K. SGONINA shows that the fleas of various small mammals are attracted to their hosts chiefly by air movements caused by respiration and feed in response to warmth and smell, sometimes on hosts on which they cannot become sexually mature; **The Role of Oribatid Mites as transmitting Agents and intermediate Hosts of Ovine Cestodes,** pp. 1669–1674, 2 pls., 6 refs., in which H. W. STUNKARD recapitulates the history of the discovery that Oribatids serve as the intermediate hosts of *Moniezia expansa* [*cf.* **28** 51]; **Die niederländischen Rassen des** *Anopheles maculipennis* **vom praktischen Standpunkt betrachtet** [The Netherlands Races of *A. maculipennis* considered from the Point of View of Practice], pp. 1675–1684, 2 refs., in which N. H. SWELLENGREBEL discusses the practicability and advantages of "species sanitation" against Anophelines and shows that it can be used for the control of *A. maculipennis* var. *atroparvus*, van Thiel, the only vector of malaria in Holland [*cf.* **24** 283]; **Eistruktur und Rassen bei** *Anopheles maculipennis* [Egg Structure and Races in *A. maculipennis*], pp. 1715–1722, 7 pls., 5 refs., in which F. WEYER describes experiments carried out in the laboratory at Hamburg, which showed that the structure of eggs of *A. maculipennis* var. *atroparvus* was not affected when the larvae from which the ovipositing females were obtained were reared under varying conditions of salinity, nutrition, temperature, illumination and background (white or black); and **Das System der Stomoxydinae. Ein Beitrag zu schwebenden Fragen der Taxonomie. 2. Vorstudie zu einer monographischen Bearbeitung der Stomoxydinae** [The Classification of the STOMOXYDINAE. A Contribution to unsolved Problems of Taxonomy. Second preliminary Study for a Monograph of the STOMOXYDINAE], pp. 1723–1733, 1 fig., 10 refs. [*cf.* **27** 120; **30** 64], in which F. ZUMPT discusses the status of certain genera of the STOMOXYDINAE, recognises 6 genera and 5 subgenera and gives a key to them.

ULLRICH (H.). **Zur Biologie der Rachenbremsen unseres einheimischen Wildes, Genus** *Cephenomyia* **Latreille und Genus** *Pharyngomyia* **Schiner.** [Contribution to the Biology of the Throat Bot-flies of our native Game, Genus *Cephenomyia* Latreille and Genus *Pharyngomyia* Schiner.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **3** pp. 2149–2162, 7 pls., 10 refs. Weimar, 1939. **Insekten als Parasiten unseres einheimischen Wildes.** [Insects as Parasites of our native Game.]—*T.c.* pp. 2163–2171, 14 refs. [Recd. 1944.]

The first paper includes records of observations in East Prussia in 1936 on *Cephenomyia ulrichi*, Brauer, and *C. stimulator*, Clark, which are parasites of elk and roe deer, respectively.

The author states that he observed swarming of males of these Oestrids daily from 25th June to 12th August. There were no females among the many flies caught during this period, and no first-instar larvae have been found by the author or others in host animals shot in June, July or August [but *cf. R.A.E.*, B **23** 221]. This suggests that the females appear much later than the males, a view supported by the fact that four females of

C. stimulator were taken while pairing on 13th August and by the finding of first-instar larvae at the beginning of September. One of the four females of *C. stimulator* contained fully developed young larvae 14 days after it was caught. The situations in the host of larvae of the three instars of *C. stimulator* and *C. ulrichi* are discussed, and records of the duration of the pupal stage of species of this genus are cited from the literature [*cf.* **10** 40 ; **23** 221] ; two examples of *C. ulrichi* completed the pupal stage in 30 and 34 days. It is generally thought that larvae of *Cephenomyia* and *Pharyngomyia* have only three instars ; the author confirms this for *Cephenomyia*, but found and describes five morphologically different groups of the larvae of *P. picta*, Mg., which evidently represent five instars. His observations and data from the literature show that *P. picta* infests all available species of deer, whereas each species of *Cephenomyia* is confined to a single species. The injury caused by these Oestrids to deer in Germany is briefly discussed.

The second paper is a survey of the various insects that attack game and fur-bearing animals and game birds in Germany, with brief notes on their bionomics and the injuries they cause. A list of the species is appended, arranged under the hosts. The author divides them into two groups, of which the first consists of insects (fleas, lice and Diptera other than Oestrids, mainly blood-sucking species) that cause little or no direct injury to the host, but are or may be important as vectors of diseases or intermediate hosts of parasitic worms, and the second comprises the Oestrids of the genera *Cephenomyia*, *Pharyngomyia* and *Hypoderma*, the larvae of which are internal parasites of deer and injure them directly. The species of *Cephenomyia* cause more mortality among their hosts than any of the others.

HEPBURN (G. A.). **A simple Insect Cage-olfactometer.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 7–12, 2 figs., 5 refs. Pretoria, 1943.

Details are given of the construction of a cage-olfactometer used for experiments with sheep blowflies in South Africa. The cage is of cloth gauze on a wooden framework 30·5 cm. square and 35 cm. high. In each of two opposite sides, is a wooden bar, disk-shaped in the middle, with a hole 2·2 cm. in diameter in the centre of the disk through which the flies can pass into a trap containing one of the two substances to be compared in a small dish covered with gauze. The trap is a glass jar with a metal lid into which is fastened a wire-mesh truncated cone, the apex opening within the jar. The trap is supported so that the mouth is in contact with the disk and most of the odour passes through the hole into the cage, relatively little escaping round the edges. A removable tray at the base of the cage, covered with a loose sheet of white blotting paper, makes it possible to take out dead flies. There is a dish containing a pad of wet cotton-wool on the tray, and a strip of cotton-wool soaked in water is suspended from the top of the cage. The flies are introduced by a cloth sleeve. The olfactometers are set up in compartments in a dark room, if possible air-conditioned, having a temperature of 26–29°C. [78·8–84·2°F.] and a relative humidity of 40–50 per cent. The interior surfaces of the compartments are uniform in colour, preferably with a non-reflecting surface, and each compartment is illuminated from above by a frosted, 25-watt, vacuum light.

Results with *Lucilia cuprina*, Wied., were most satisfactory if the flies were previously kept for two days at 25°C. [77°F.] and a minimum relative humidity of 33 per cent. and deprived of food but liberally supplied with water for 24 hours before exposure. In each experiment, 100–200 flies are used per cage and two substances are tested, one in each trap. The necessary exposure varies with the substance and may be as much as four hours, though 1½ hours is usually sufficient. At the end of the test, the flies are counted and their sex is determined. The traps are then aired in the sun and the bait containers

cleaned, and the test is repeated with the position of the traps reversed. After the conclusion of an experiment, the apparatus is cleaned and put in a sunny place for about an hour. The cones must be washed in hot water and placed in a jet of steam for ten minutes to remove the odour of beef bait. The standard bait with which others are compared is 2·5 cc. undiluted beef liquor prepared by mixing an equal weight of minced beef and water inoculated with a culture of bacteria from sheep intestines, incubating for 40 hours at 37°C. [98·6°F.] and centrifuging for 20 minutes. To determine whether a substance is attractive, it may be compared with a known attractant, water or a blank, according to circumstances. The obscurant value of any substance can be determined by putting the same attractant in both traps and adding the test substance in a separate container in one trap. It should not be poured over the attractive bait. Specimen results are given showing the precision of the apparatus, the great sensitivity of the flies and the necessity for cleaning the traps thoroughly between tests.

HEPBURN (G. A.). **Sheep Blowfly Research. I. A Survey of Maggot Collections from live Sheep and a Note on the Trapping of Blowflies.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 13–18, 1 graph, 2 refs. Pretoria, 1943.

A survey of the blowflies infesting sheep in the main sheep-farming areas of the Union of South Africa was made in 1940–42. More detailed records were also kept by P. A. Cilliers of infestations at Onderstepoort, Transvaal, and Dohne, Cape Province, in 1939–1940 and 1940–1941, respectively. Of 324 collections of larvae, 55 per cent. comprised *Lucilia cuprina*, Wied., alone and 36 per cent. consisted of this species with another or others. *Chrysomyia chloropyga*, Wied., *L. sericata*, Mg., and *C. albiceps*, Wied., were involved in 35, 17·5 and 2 per cent. of the collections. The author considers that it may be assumed that statements concerning *L. sericata* in the literature on blowflies in South Africa [*R.A.E.*, B **16** 81 ; **20** 37] refer to *L. cuprina*. It is suggested that the relatively high incidence of *C. chloropyga* in the Transvaal (excluding Onderstepoort) and Natal, where most strikes were made by this species in combination with *L. cuprina*, may be correlated with the high rainfall and humidity of Natal and the eastern Transvaal.

Traps baited with meat were exposed almost continuously at Onderstepoort from May 1940 to July 1942. The catches of *L. cuprina* per trap per day decreased from 58 in May to 2 in July 1940, increased steadily to 44 in September, dropped to 23 in November, then rose rapidly to the maximum (120) in December, declining again fairly quickly to a minimum of one and remaining low throughout the winter. An increase occurred in September and the maximum for the second season (34) was reached in February. The low catches in the second season may be due to the fact that the summer was hotter and drier than the previous one. *C. chloropyga* was most abundant in September and October of each year. *C. albiceps* reached its maximum abundance in October and December and there was a minor peak in May. *C. marginalis*, Wied., appeared to be most abundant from October to January or February, but the maximum daily catch of this species was five and fresh sheep carcasses sometimes attracted it in hundreds while it did not enter traps close by. Attempts to rear it in cages were not very successful as oviposition was most erratic. *L. cuprina* is more readily attracted to meat-baits in early stages of decomposition than to those in the more advanced stages, whereas the reverse is true of *C. albiceps*. It is therefore important to expose selective baits to obtain a true impression of the density of different species. As *C. marginalis* does not attack living sheep, but is a good scavenger, there is no object in trying to find a highly attractive bait for it.

NOLTE (M. C. A.). **Sheep Blowfly Research. II. Suint Investigations.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 19–25, 11 refs. Pretoria, 1943.

The constituents of suint and problems arising in its analysis are discussed, and an account is given of attempts to isolate and estimate some of the organic acids, chiefly lower fatty acids, said to be present in small quantities in it. Apart from the identification of benzoic acid as a decomposition product of hippuric acid, a satisfactory separation of these acids was not achieved, owing to the small quantities present. In olfactory tests, preparations and extracts failed to attract blowflies. No correlation between suint composition and blowfly infestation of sheep could, therefore, be demonstrated.

HEPBURN (G. A.) & NOLTE (M. C. A.). **Sheep Blowfly Research. III. Studies on the olfactory Reactions of Sheep Blowflies.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 27–48, 36 refs. Pretoria, 1943.

Australian workers have shown that the extensive use of traps for blowflies may reduce infestation of sheep by some 50 per cent. [*R.A.E.*, B **25** 11], but to trap with meat on the scale they describe would be too expensive to be practicable in South Africa. However, if an inexpensive, readily procurable and easily prepared bait could be found, that was effective against *Lucilia cuprina*, Wied., for a fairly long time, trapping in combination with other control measures might be considered. An account is given of tests carried out between April 1940 and September 1942 on the attractiveness of various suint preparations, pure chemicals, chemically treated meat, extracts of beef, fermenting baits, and distillates of flowers of *Stapelia flavirostris*, which were attractive to *L. cuprina*. Inoculation of meat bait with a mixed culture of bacteria from sheep intestines increased its attractiveness, and chemical treatment often increased the attractiveness of meat for *L. cuprina* and sometimes for *Chrysomyia chloropyga*, Wied., also. The results are discussed, and it is concluded that no attractant superior to chemically treated beef bait has been found and that the attractiveness probably lies in a mixture of odours. Calcium carbonate gave promising results in laboratory tests ; and in field tests in which it was used at 3 per cent. of the total weight of the bait (minced bovine liver) plus water, it was the most satisfactory of three chemicals tested, the bait containing it catching 106 individuals of *L. cuprina*, 92 of *L. sericata*, Mg., 208 of *C. chloropyga*, 2,683 of *C. albiceps*, Wied., and 602 of *C. marginalis*, Wied., while the untreated control bait caught 1, 1, 2, 5 and 15, respectively. Suggestions are made for further work on the subject.

HEPBURN (G. A.) & NOLTE (M. C. A.). **Sheep Blowfly Research. IV. Field Tests with chemically treated Carcasses.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 49–57. Pretoria, 1943.

An account is given of experiments by which it was hoped to find a method of regulating the pH of carcasses at a level attractive to primary sheep blowflies and to find a poison that would do this and also render the carcasses toxic to the flies and their progeny. Guineapig carcasses were used, and the pH was measured in a thigh muscle. It was found that the pH of opened carcasses could not be controlled satisfactorily by dusting with chemicals, and it is considered unlikely that better results could be obtained by using solutions. The attractiveness of carcasses and meat baits appears to depend on a number of factors and on the nature of any added chemical, not on pH alone. Flies, including *Lucilia cuprina*, Wied., came more readily in the first two days to untreated carcasses than to those treated with an inert powder, but later the latter appeared equally attractive. The pH did not differ significantly from catch to catch, nor was there a correlation of pH with catch.

HEPBURN (G. A.). **Sheep Blowfly Research. V. Carcasses as Sources of Blowflies.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 59–72, 1 fig., 9 refs. Pretoria, 1943.

The experiments described were designed to determine the species of flies that breed in carcasses under field conditions in South Africa. At first, sheep carcasses were exposed in halves of oil drums containing sand, but as larvae could easily escape and larvae and the adults trapped on emergence were sometimes destroyed by ants (*Pheidole megacephala*, F.), larger rectangular metal troughs with the edges turned inwards and downwards at an angle of 45° and a guard of wire gauze lying parallel to the sides of the trough were substituted in later work, and the troughs were placed on platforms, the supports of which were painted with adhesive. A special lid provided ventilation and incorporated a trap for the emerging adults. Parasites and predators other than ants had access to the carcasses, but tubes opening at the level of the surface of the sand and leading to tins also containing sand gave the maggots a chance of escaping from the parasites as they do in nature by migration. Two exposures were always compared, varying from one and three days in summer to three and ten in winter. The purpose of the longer was to study unchecked competition. The bodies of various small animals were also exposed to flies.

Detailed results are given in tables. The flies bred during the cool time of the year comprised mainly *Lucilia cuprina*, Wied., the most important primary fly, *L. sericata*, Mg., and *Chrysomyia chloropyga*, Wied., also a primary fly, while the mid-summer populations were principally composed of *C. marginalis*, Wied., and *C. albiceps*, Wied., a secondary fly. *C. marginalis* was attracted to carcasses in the first stage of decomposition. In summer, it almost immediately followed *L. cuprina* and *L. sericata*, which were usually the first species to go to fresh carcasses. *Musca* spp. came when the carcass had been broken down, presumably attracted by the exposed contents of the digestive organs, and Sarcophagids also came late in decomposition. Succession did not operate in winter. Fly populations from small and big carcasses seemed very similar in composition, and small carcasses often produced large numbers of primary flies. Competition between the species is discussed. It is stated in a foot-note that experiments made by Ullyett at Pretoria showed that larvae of *C. albiceps* prey on those of *Lucilia* spp. [*cf. R.A.E.*, B **18** 273], but there was no evidence that those of *C. marginalis* do so. *Mormoniella vitripennis*, Wlk., parasitises particularly *C. albiceps* and *C. chloropyga*, as *Lucilia* larvae usually migrate before they are attacked.

It is concluded that the prompt disposal of carcasses is most important in the season when they breed *Lucilia* spp. and *C. chloropyga*. In summer, *C. marginalis* might be fostered by burying carcasses three days after the death of the animal. The effect of burial on larvae of various species is discussed from the literature.

MÖNNIG (H. O.). **Sheep Blowfly Research. VI. The Treatment of Myiasis.**—*Onderstepoort J. vet. Sci.* **18** no. 1–2 pp. 73–84, 6 refs. Pretoria, 1943.

As the chief source of *Lucilia cuprina*, Wied., in summer in South Africa is living sheep [*cf.* preceding abstract], it is essential that a dressing for strikes should not merely dislodge the larvae but kill them rapidly by contact before they can escape. It should also be cheap, cause the wounds to dry and heal quickly and make them unattractive to ovipositing females. Studies carried out with a view to developing a satisfactory dressing spray are discussed. Experiments were made on artificial strikes as *in vitro* tests had been found unreliable. The strike area was clipped when the maggots were full grown and almost ready to leave the sheep, and the dressing was poured or sprayed on to it. The maggots were left on the dressed wound for 1–3 minutes and then removed

to clean sand. Alkalinity and moisture favour the maggots, and therefore acid, astringent and drying effects were aimed at. Wattlebark extract had previously been tried, but was discarded as it had certain serious defects, particularly a tendency to encourage restrike in the surrounding healthy area. This is probably because aqueous dressings provide a source from which the suint in the immediate vicinity draws water and forms a new attractive focus. Coal-tar distillates were chosen as the larvicide, and the fractions used were neutral and free of naphthalene, as naphthalene, tar acids and tar bases caused irritation to the sheep. The best fractions were benzene, light naphthas boiling at 140–160°C. and creosote oils boiling at about 200–240°C. In tests of the effect of adding different quantities of tar acids to these fractions, 5 per cent. phenol tended to make some of the fractions less effective than 2·5 per cent., while cresols had the opposite effect. The addition of an equal amount of ethyl alcohol (96 per cent.) greatly enhanced the larvicidal action of the neutral tar oils, and the further addition of a suitable acid increased effectiveness, made the wounds unattractive and promoted rapid healing. Tartaric acid was the most satisfactory but soon became unobtainable, and sulphuric acid was found to be a good substitute provided quantities were carefully balanced. Liquid paraffin was included for its soothing and softening effect. Seven specifications are given, six of which gave complete mortality of larvae. The one finally chosen contained 43 per cent. alcohol, 43 per cent. creosote oil, 11·25 per cent. liquid paraffin, 2·5 per cent. cresols and 0·25 per cent. sulphuric acid. It gave excellent results under field conditions both against sheep blowflies and against *Chrysomyia bezziana*, Villen., on cattle. Restrikes were rare and limited to cases of continued scouring or soiling by urine and to fighting rams. It readily killed ticks on cattle and two applications cured severe sarcoptic mange [caused by *Sarcoptes suis*, Gerl.] on white pigs six weeks old. It causes the healthy skin of sheep to harden and a thin scab to form, but this is cast after about a week, leaving healthy skin. There was little or no effect on the skin of other animals, including the ears of cattle, or on human skin.

A revised formula necessitated by the shortage of liquid paraffin and creosote oil and irritation arising from incomplete extraction of tar bases and naphthalene is dealt with in an addendum. The ingredients in the final mixture with the percentage of each by volume in brackets, were alcohol (40), motor oil (5), light fuel oil (10), cresols (2·5), sulphuric acid (0·15), benzene (21·175) and neutral creosote oil with a boiling point of 200–240°C. (21·175). It was as effective against blowfly larvae and ticks as the first mixture and caused no apparent pain. Irritation was less in sheep with a relatively dry fleece than in those with much suint.

DEORAS (P. J.) & ARJAN SINGH JANDU. **The House-fly and its Control.**—*Indian Fmg* **4** pp. 565–568, 6 figs., 3 refs. Delhi, 1943.

The commonest house-fly in India is *Musca nebulo*, F., while *M. sorbens*, Wied., *M. ventrosa*, Wied., *M. domestica vicina*, Macq., and *M. conducens*, Wlk., are frequently found in houses. At 30–35°C. [86–95°F.], the egg and larval stages of *M. nebulo* last 12 hours and 3–6 days, respectively. The female has mated and is ready to oviposit within 2–4 days of emergence, and may lay 5–6 batches of eggs with 120–150 in each [*cf. R.A.E.*, B **27** 109]. The entire life cycle takes 7–14 days. The winter is passed in the adult stage. Very few eggs and larvae survive the heat of May and June in northern India.

The importance of cleanliness in the control of flies is stressed. On farms where the quantity of dung is small, it should be spread out in the sun in a layer about one inch thick, over which dry powdered lime may be scattered to keep the flies away, and raked daily for four days. It can then be put into pits. If there is a large quantity of dung, it should be put into deep trenches, which should be cemented if possible, surrounded by a small channel containing oiled

water. A piece of tarred material should be laid over it and tucked in. As fermentation proceeds, the larvae are killed by the extreme heat or drowned in the oiled water in trying to avoid it. The maximum temperature recorded in a covered heap was 71°C. [159·8°F.] at a depth of six inches in October when the temperature of an uncovered heap at the same depth was 48°C. [118·4°F.]. After a fortnight, a thin layer of soil is substituted for the covering. Borax (1 lb. in 16 gals. water per 16 cu. ft. dung) or creosote (1 pint in 2 gals. water per 10 cu. ft.) will kill eggs and larvae.

Methods recommended against the adult flies include poisoning with formalin and sugar in milk and water, the use (at 1½ oz. per 100 cu. ft.) of candles made of five parts pyrethrum powder, one part sawdust, two parts cow-dung or wheat flour and two parts potassium nitrate in water, spraying (at 1 oz. per 100 cu. ft.) with an extract of pyrethrum made by steeping 1 lb. powdered flowers in 1 gal. refined kerosene for 12 hours and adding 3 oz. oil of wintergreen to the clear liquid, fly papers, for which a specification is given, and traps. Two modifications of a trap already noticed [**24** 104] are described. One has a dark central chamber on each side of which is a compartment with a wire-gauze roof extended to form part of the outer side. The flies are attracted to the bait in the centre chamber and enter through small holes in the sides. They are then attracted to the better lighting of the side compartments, which they enter through small holes in gauze cones, and die of starvation or are poisoned by formalin. The second trap is similar in principle but has only one dark and one light chamber, and the flies in the latter are killed in a tray of oiled water. Baits that have been tried with success are fermenting oilcake with water, fermenting oilcake with meat entrails, fermented sugar syrup with vinegar, and milk with rotting bananas. The omission of the cow-dung and soil recommended by Shaffi in the first bait [**24** 104] reduced the offensive smell without decreasing effectiveness. The first two are recommended for dairies and the last two for dwellings.

Lotze (J. C.). **Carrier Cattle as a Source of infective Material for Horsefly Transmission of Anaplasmosis.**—*Amer. J. vet. Res.* **5** no. 15 pp. 164–165, 7 refs. Chicago, Ill., 1944.

Negative results were obtained in four attempts made in Maryland in 1941 to transmit anaplasmosis (*Anaplasma marginale*) by the interrupted feeding of *Tabanus sulcifrons*, Macq., to susceptible cattle from three animals that had been experimentally infected 11–17 months previously and in the blood of which anaplasms were not demonstrable by microscopic examination [*R.A.E.*, B **31** 230]. In August 1943, two attempts were made to effect transmission by the same Tabanid while anaplasms were microscopically demonstrable in the blood of the source animal during a mild subclinical relapse. The animal had been experimentally infected about 11 months earlier. One of the calves that served as test animals received 72 bites from 17 flies on 3rd August and 59 bites from 15 flies on 4th, and the other received 81 bites from 23 flies on 5th. On these three days, about 0·09, 0·13 and 0·19 per cent., respectively, of the erythrocytes of the source animals contained anaplasms [*cf.* **30** 100]. Results were positive, organisms being first observed in the blood of the calves on 2nd September. The possible significance of this in relation to outbreaks of the disease is pointed out.

Mathis (M.) & Nicolle (P.). **Sur le comportement des réduvidés hématophages *Rhodnius prolixus* Stål et *Triatoma infestans* Klug, et leur aptitude à transmettre la maladie de Chagas.**—*C. R. Soc. Biol.* **135** p. 28. 1941. (Abstr. in *Bull. Inst. Pasteur* **41** no. 9–10 p. 300. Paris, 1943.)

First-instar nymphs of *Rhodnius prolixus*, Stål, and *Triatoma infestans*, Klug, excrete very little after feeding, but the older nymphs and adults emit

much larger quantities of excreta. The authors observed that bugs that had bitten the host while in a position perpendicular to the skin with the head downwards, pivoted through an angle of 180°, emitted excreta and returned to their original position to resume feeding. This behaviour is likely to favour the penetration of metacyclic trypanosomes, and consequently the transmission of *Trypanosoma cruzi* through infective excreta. The pivoting was observed only when the bugs fed head downwards, which is their preferred position.

NICOLLE (P.) & MATHIS (M.). **Le thermotropisme, facteur déterminant primordial pour la piqûre des réduvidés hématophages.**—*C. R. Soc. Biol.* **135** p. 25. 1941. (Abstr. in *Bull. Inst. Pasteur* **41** no. 9–10 p. 301. Paris, 1943.)

Experiments on *Triatoma infestans*, Klug, and *Rhodnius prolixus*, Stål, showed that the temperature of the host plays a fundamental part in stimulating them to feed. Cold, dead bodies of warm-blooded animals did not attract them. On the other hand, any liquid or solid with a temperature of 20–40°C. [68–104°F.] caused them to put the rostrum in the position for insertion. Any lukewarm liquid presented behind a membrane induced its insertion. This thermotactism explains the choice of food by Triatomids and also the cannibal tendencies that they sometimes show [see next abstract].

NICOLLE (P.) & MATHIS (M.). **Sur le cannibalisme spontané et expérimental chez les réduvidés hématophages.**—*C. R. Soc. Biol.* **135** p. 73. 1941. (Abstr. in *Bull. Inst. Pasteur* **41** no. 9–10 p. 301. Paris, 1943.)

Cannibalism can be induced experimentally in Triatomids by presenting to unfed nymphs an engorged one that has been brought to a temperature of 37–39°C. [98·6–102·2°F.]. Unfed nymphs engorge on newly ingested blood in another nymph as long as it remains warm. Natural or experimental cannibalism is thus a special case of alimentary thermotropism.

NICOLLE (P.) & MATHIS (M.). **Absorption de solutions salines par le réduvidé hémophage *Triatoma infestans* Klug. Importance de la concentration.**—*C. R. Acad. Sci.* **212** p. 514. 1941. (Abstr. in *Bull. Inst. Pasteur* **41** no. 9–10 p. 301. Paris, 1943.)

The importance of the temperature of liquids exposed to Triatomids in inducing them to feed is greater in the case of artificial feeding through a membrane than in that of normal feeding on animals. For *Triatoma infestans*, Klug, the optimum temperature for feeding through a membrane is 42°C. [107·6°F.]. Solutions of any salt may be ingested under these conditions, but the amount of solution taken in varies with the amount of the salt in the solution. It is very small in the case of pure water, reaches its maximum when the osmotic pressure of the liquid is the same as that of the plasma of warm-blooded animals and then decreases rapidly. The pH of the solution also influences feeding, 7·8 being a favourable level. These preferences are thought to be governed by osmotic modifications in the digestive apparatus and not by taste.

CARTER (H. F.), WEDD (G.) & D'ABRERA (V. St. E.). **The Occurrence of Mites (Acarina) in human Sputum and their possible Significance.**—*Indian med. Gaz.* **79** no. 4 pp. 163–168, 13 refs. Calcutta, 1944.

The authors record the discovery of mites in the sputum of 17 out of 28 persons suffering from respiratory disorders in Ceylon, and describe the

precautions taken to prevent contamination of the samples from outside sources and the methods of examining the sputum and the mites. At least ten species were found; some have not yet been identified, and the others were not parasitic types, but species that are commonly present in stored products and débris of various kinds; they included members of the genera *Tyroglyphus* (sens. lat.), *Carpoglyphus*, *Glycyphagus*, *Cheyletus* and *Tarsonemus*. The mites were found in small numbers in approximately half the sputum samples taken from the infested persons until they were treated with arsenical preparations, after which the numbers diminished, and many of those seen appeared to be in a macerated condition. In three of the patients, an eosinophilia of 38-66 per cent. was observed, and in all of these the chest conditions improved and the eosinophilia was much reduced after treatment with arsenic; in one case, 29 mites, mostly *Carpoglyphus*, in all stages, were expectorated immediately after the initial dose of stovarsol. No mites were recovered from samples of saliva or nasal washings, suggesting that the mites did not come from the mouth or nasal passages of the patients, and it is therefore considered that they came from the lungs or bronchi or both. The presence of similar mites in dust and in the air suggests that the chief method of infestation is by inhalation, and in some instances the evidence indicated that the period of infestation may be much prolonged. In one case in which mites (*Tyroglyphus* and *Carpoglyphus*) were present in the sputum in considerable numbers and in all stages from eggs to adults of both sexes, including egg-bearing females, and infestation had apparently lasted not less than seven months, it is considered that the mites had adapted themselves to the conditions present and were breeding.

The view is advanced that the condition variously known as pseudo-tuberculosis, eosinophil lung and tropical eosinophilia may be explained, at least in part, on the basis of infestation of the respiratory system by mites.

SMITHERS (R. H. N.). **Contributions to our Knowledge of the Genus *Latrodectus* (Araneae) in South Africa.**—*Ann. S. Afr. Mus.* **36** pt. 3 pp. 263–313, 1 pl., 2 fldg. maps, 20 figs., 79 refs. Cape Town, 1944.

Most of the cases of illness or death due to the bite of females of *Latrodectus indistinctus*, P. Camb., in South Africa [*cf. R.A.E.*, B **25** 151] occur during the harvest season in the grain lands of the coastal belt of the Western Province. During this season, when the spiders are particularly numerous, reaping operations destroy or expose their nests, and they build new ones under the sheaves lying on the stubble to dry. The men who stack these collect several under their arms, and so may disturb the spiders and cause them to bite. During the 1936 harvest, a survey of a considerable area showed that one of every six sheaves had a nest on the underside. A detailed account is given of the bionomics of this spider, including the method of building the nest, mating and depositing the eggs and the development of the young within the egg-sacs and their dispersal, with short notes on *L. geometricus*, Koch, which has only once been recorded as causing illness by its bite and has a much less potent venom than *L. indistinctus* [*cf. loc. cit.*]. It is considered likely that both species occur throughout South Africa; their known distribution there is shown on maps.

The author also describes both sexes of *L. geometricus* and *L. indistinctus*, discusses and figures the abdominal pattern of the immature stages of the latter and distinguishes a new variety, *L. indistinctus* var. *karrooensis*, which appears to occur only in the high parts of the Karroo, on the basis of differences in abdominal pattern and coloration in the adults and differences in the nests and webs. He considers that *L. concinnus*, P. Camb. [*cf. loc. cit.*] is a synonym of *L. geometricus*, since examination of the types showed that they agreed in every respect but darkness of colour, and every variation from pale grey to black has been found in the field.

Blickle (R. L.). **The relative Effects of falling, rising, and constant Concentrations of Sulphur Dioxide on the Confused Flour Beetle and the Granary Weevil.**—*Abstr. doct. Diss. Ohio Univ.* no. 40, pp. 17–20, 11 refs. Columbus, Ohio, 1943.

The author describes a method that was developed for obtaining and analysing data on the relative effectiveness of constant, increasing and decreasing concentrations of fumigants against insects, using sulphur dioxide as the fumigant, *Tribolium confusum*, Duv., and *Calandra* (*Sitophilus*) *granaria*, L., as the test insects, and a modification of an apparatus already noticed [*R.A.E.*, A **26** 21]. Although the differences were small, the results supported the validity of the method. Statistical analysis showed that the median lethal concentration for *T. confusum* was lowest for decreasing concentrations and highest for increasing ones, indicating that the initial concentration had more effect on mortality than the final one. Possible reasons for this are discussed. Repeated fumigations at low concentrations were less effective against this species than a single treatment starting at a high concentration. The median lethal concentrations for one hour's exposure to a constant concentration at 22±1°C. [71·6±1·8°F.] were 8·5 mg. per litre for *T. confusum* and 10·1 mg. per litre for *C. granaria*.

Swisher (E. M.). **The Toxicity and Fumigation Characteristics of Sulphur Dioxide, Acetone, and Ethylene Oxide alone and in Combination.**—*Abstr. doct. Diss. Ohio Univ.* no. 42 pp. 153–162, 5 refs. Columbus, Ohio, 1943.

The value of sulphur dioxide for the fumigation of buildings of the type in which bed-bugs [*Cimex lectularius*, L.] are most likely to occur and where an inexpensive fumigant is needed depends on the development of a simple, reliable and safe method of application. It has been found that sulphur dioxide forms loose combinations, which may be liquids or solids, with certain organic compounds, including amines, ethers and ketones, from which it is rapidly released on exposure to air at room temperature. When it is mixed with acetone or ethylene oxide, liquid compounds, $C_3H_6O{\cdot}SO_2$ and $C_2H_4O{\cdot}SO_2$, are formed. These have a reduced vapour pressure and are stable when confined, but readily decomposed into their component parts upon exposure to air. Laboratory tests were therefore made to determine the relative toxicity of sulphur dioxide, acetone and ethylene oxide and the type of joint toxic action that occurs when sulphur dioxide is applied with 10, 20, 30, 40 or 50 times its weight of acetone and with 1 or 5 times its weight of ethylene oxide. The test insects were flour beetles (*Tribolium confusum*, Duv.), the exposure period was five hours, and final mortality counts were made at the end of 120 hours. The median lethal concentrations were found to be 5·6 mg. per litre for sulphur dioxide, 18·4 for ethylene oxide and 168 for acetone. The effects of changes in dosage on mortality were found to be similar, but the reactions of the insect to the fumigants were very different. Sulphur dioxide acted quickly, and only about 3·5 per cent. of the beetles that appeared to be dead after exposure recovered during the following ten days; acetone appeared to exert an anaesthetic effect, and all dosages that eventually killed 10 per cent. or more completely anaesthetised all the beetles for several hours, after which the survivors gradually became normal; and ethylene oxide exhibited delayed action, all the beetles being very sluggish after exposure, and no clear distinction between dead and living being possible for approximately three days. The author considers that sulphur dioxide and acetone, mixed in the ratios of 1 : 20, 1 : 30, 1 : 40 and 1 : 50, and sulphur dioxide and ethylene oxide (1 : 5) exerted independent similar toxic action [*cf. R.A.E.*, A **28** 199]; no satisfactory conclusions could be drawn concerning the toxic action of sulphur dioxide with acetone and ethylene oxide in the ratios of 1 : 10 and 1 : 1,

respectively, as the amounts of acetone and ethylene oxide in these mixtures fall below the limits of the dosage mortality curves for the compounds alone. The percentage kills for 4 mg. SO_2 and 120 mg. acetone per litre were 5·4 and 4·1, respectively and that of a mixture of these quantities was 89·5.

Since sulphur dioxide is not inflammable in any proportion in air and acetone and ethylene oxide are highly inflammable in certain concentrations, mixtures containing different proportions of sulphur dioxide may be expected to vary considerably in inflammability. Experiments were therefore carried out to ascertain the exact range of inflammability of such mixtures and to determine the explosive ranges for the molecular combinations. It was found that the latter were less inflammable than hydrocyanic acid gas and could be considered safe fumigants and that the lowest proportions of sulphur dioxide that could be mixed with acetone and ethylene oxide to produce gases that were not inflammable at any concentration in air were 1·9 : 1 and 3·5 : 1 by volume, respectively. Mixtures containing more than 75 per cent. acetone would be dangerous to use under practical conditions.

Since the factor of inflammability limits the use of mixtures containing only a small proportion of sulphur dioxide, it is desirable to use as large a proportion as possible. However, the practical use of mixtures containing more than 50 per cent. by volume is limited by the factor of vapour pressure. Tests were made in a fumigation chamber, which had a capacity of 740 cu. ft. and was furnished as a bedroom, to determine the toxicity of sulphur dioxide and acetone, mixed in the molecular ratio (1 : 1·6 by volume) and in equal quantities, to flour beetles, bed-bugs and carpet-beetle larvae, the time required for aeration after exposure and the effect of the fumigant on various materials commonly present in houses. Mixtures prepared by passing liquid sulphur dioxide slowly into acetone were poured into a jar containing celite pellets, and the gas was released by pouring this on a screen in the chamber. The temperature was kept constant at approximately 77°F., but the humidity, dosages and length of exposure were varied. Both combinations proved to be highly toxic, but the one containing equal quantities is better than the other as it contains a larger proportion of sulphur dioxide. Doses of approximately 2 and 2½ lb. per 1,000 cu. ft., respectively, were highly effective against carpet-beetle larvae, bed-bugs and flour beetles after an exposure of either 8 or 15 hours, and 1 lb. per 1,000 cu. ft. of the former was effective against all stages of the bed-bug in 15 hours. Satisfactory aeration of the room and of absorbent materials within it was attained in two hours and 4–8 hours, depending on the humidity, respectively. The combined fumigant appeared to cause no injury to metals and fabrics, the presence of acetone vapours apparently reducing the formation of sulphurous acid, but, as a precaution, fumigations should be carried out under conditions of average humidity. It has also the advantages that the entire dose can be released at once [*cf.* preceding abstract], there is no danger of fire, and the possibility of injury is decreased by the absence of the impurities that are present when sulphur is burned. The author concludes that it could be marketed as an inexpensive, safe and effective household fumigant that could be easily and quickly applied.

PAVLOVSKY (E. N.). *Dyromys nitedulus* **Pall. as a possible Reservoir of the Virus of Tick Relapsing Fever.**—*C. R. Acad. Sci. URSS* (N.S.) **39** no. 7 pp. 286–288. Moscow, 1943.

Details are given of experiments showing that *Dyromys nitedulus*, a small rodent widely distributed in Central Asia and European Russia, is very readily infected with the spirochaetes of tick-borne relapsing fever. The infections were produced by inoculation of the blood of guineapigs harbouring a Tadzhikistan strain transmitted by *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) or a Georgian strain transmitted by *O. verrucosus*, Olen., Zas. & Fen., or

by the feeding of examples of *O. tholozani* infected with another Tadzhikistan strain. Most of the animals survived the infection and the spirochaetes persisted in their blood for up to 32 days.

In nature, *D. nitedulus* is associated with woods and the species of *Ornithodoros* are not, but it might serve as host for *O. tholozani* or *O. tartakovskyi*, Olen., in Central Asia in oases or along the edges of woodland in the mountains, and thus act as a reservoir of relapsing fever.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Protection from blood-sucking Diptera (Mosquitos, Midges, Sandflies, Tabanids, etc.).** [*In Russian.*]—67 pp., 17 figs., 5 refs. Moscow, Acad. Sci. U.S.S.R., 1941. Price 90 *kop.* [Recd. 1945.]

This booklet, which is intended for Army use, contains brief notes on the habits of blood-sucking Diptera and on the diseases they transmit to man and animals, followed by a survey of methods of protecting man and horses from them, based on the literature and on experiments in various parts of the Russian Union.

Effective protection against mosquitos and other insects has been obtained by the use of mittens and a headpiece made of coarse net impregnated with a repellent. The net is of thick cotton cord with meshes about ½ in. wide. The headpiece measures 20 × 28 ins. and is edged with tape, pieces of which hang from the corners of one of its wider sides so that it can be tied to hang over the back and sides of the head and on to the shoulders. The face is left uncovered, but a narrow strip of the net hangs from the peak of the cap. The net is impregnated by steeping it for several hours or boiling it for 3–4 hours in a repellent mixture. Of several mixtures given, the best were 15 parts lysol, 8 parts turpentine and 77 parts water, and a 10 per cent. emulsion of birch tar, the latter being of particular value against *Phlebotomus*. A net remains effective for 10–12 days, without retreatment, but should be kept folded and wrapped when not in use. Hoods of other materials can be used if suitable netting is not available, but they must be thick enough to hold a heavy charge of repellent.

Impregnated netting also proved very effective as a bed-curtain against mosquitos, or to screen the entrance and bottom edges of tents, and horses can be protected from flies by hanging treated ropes or weighted strips of fabric to screen the entrances of stables and by attaching treated material to harness.

Blagoveshchensky (D. I.), Bregetova (N. G.) & Monchadsky (A. S.). **New deterrent Substances for protecting Man against Attacks of Mosquitoes.**—*C. R. Acad. Sci. URSS* (N.S.) **40** no. 3 pp. 119–122, 8 refs. Moscow, 1943.

Turpentine, which is recommended by Pavlovskiĭ in mixtures for treating nets used for a protection against mosquitos [see preceding abstract] is not readily available in Central Asia, but experiments carried out in Tadzhikistan in the course of observations already noticed [*cf. R.A.E.*, B **32** 214] showed that *d*-α-pinene is a very efficient substitute. It is obtained as a waste product in the process of purification of juniper oil from young twigs of *Juniperus serevschanica*, which is common in Central Asia at an altitude of over 6,560 ft. The nets were equally effective when impregnated with the pinene alone or with a mixture containing it, such as lysol, pinene and water. Men wearing them in the open were each attacked by only 1–3 mosquitos in 15–30 minutes while unprotected men were each attacked by over a hundred.

Tests at the beginning of October in a district in which *Anopheles superpictus*, Grassi, was abundant in dwellings and animal quarters, showed that hardly any mosquitos entered an inhabited hut through a window that was screened with a net impregnated with the pinene.

GUTSEVICH (A. V.). **On the Mosquitoes of North Iran.**—*C.R. Acad. Sci. URSS* (N.S.) **40** no. 3 pp. 123–125, 3 refs. Moscow, 1943.

A list is given of mosquitos found in northern Persia in May–July 1942, showing their abundance in two provinces on the Caspian coast and two on the Iranian plateau. The species of *Anopheles* taken were *A. maculipennis*, Mg., *A. superpictus*, Grassi, *A. hyrcanus*, Pall., *A. claviger*, Mg. (*bifurcatus*, auct.), *A. algeriensis*, Theo., *A. plumbeus*, Steph., and *A. pulcherrimus*, Theo. *A. maculipennis* was very abundant and associated with severe malaria in the humid Caspian provinces, where it bred in the numerous rice-fields. Examination of eggs showed that it was represented by two varieties in these provinces, of which one was var. *sacharovi*, Favr. It occurred in small numbers only in the much less malarious plateau provinces, which are at an altitude of over 3,000 ft. and are characterised by a dry climate, scarcity of water and poor vegetation. Of the other Anophelines, the only one considered of any importance in relation to malaria is *A. superpictus*. It was found in two districts, both on the plateau, but does not become abundant until late summer and autumn.

[MACHUL'SKIĬ (S. N.).] **Мачульский (С. Н.). Preparations of Tar-oil against Infestation of agricultural Animals with Ectoparasites.** [*In Russian.*]—*Veterinariya* **21** no. 1 pp. 21–22. Moscow, 1944.

Treatment with an emulsion and an ointment containing gas-works tar oil was successfully used in the Buryat-Mongol Republic in 1942 and 1943 to control mange caused by *Psoroptes* on horses and cattle and by *Sarcoptes* (*Acarus*) *suis*, Gerl., on pigs. The emulsion contained tar oil and soft soap in the ratio of 3 : 2 and was diluted to a concentration of 2·4 per cent. tar oil, as this was the concentration at which it killed all mites removed from their hosts and exposed in the laboratory. The ointment consisted of 6 parts tar-oil, 4 parts soft soap and 90 parts seal fat. The emulsion was warmed to a temperature of 30–40°C. [86–104°F.] and applied by scrubbing the infested areas or whole body of the animal with a brush and the ointment was applied to the same areas after 24 hours. The double treatment was repeated a week later, though tests on a few animals indicated that this may not be necessary.

The emulsion killed lice on cattle and pigs in 1–2 minutes when diluted to a concentration of 1·2 per cent. tar oil and destroyed Mallophaga on fowls when it contained only 0·12 per cent.

[KORNIENKO (KONEVA) (Z. P.) & SHMUIREVA (M. K.).] **Корниенко (Конева) (З. П.) и Шмырева (М. К.). On the Possibility of the Transmission of Theileriasis to their Progeny by the Ticks *Hyalomma turkmeniense* (Olenev, 1931).** [*In Russian.*]—*Veterinariya* **21** no. 4 pp. 24–25. Moscow, 1944.

In 1939 females of *Hyalomma turkmeniense*, Olen., taken in Central Asia on cattle infected with *Theileria*, were allowed to oviposit in the laboratory, and their offspring were reared by feeding the larvae and nymphs on rabbits. In September, 50 of the resulting adults were placed on a healthy calf, on which they engorged in 5–11 days. The calf did not show infection in the autumn of 1939, but did so in the spring of 1940. To obtain a more definite result, a further 30 of the ticks were sent to Omsk, where the disease does not occur. There they engorged in 8–13 days on a healthy bullock, and it became infected 11 days later, *Theileria* bodies being present in its blood for 5–6 days.

It is pointed out that the results of this experiment differ from those of previous workers who concluded that infection with *Theileria* is not passed through the egg in ticks of the genus *Hyalomma* [*cf.* *R.A.E.*, B **24** 156; **26** 26; **31** 105].

[Demidov (N. G.), Starukhin (P. Ya.) & Dmitriev (G. N.).] **Демидов (Н. Г.), Старухин (П. Я.) и Дмитриев (Г. Н.). Investigations on the parasitic Ixodid Ticks and Hemosporidioses of Horses in North Caucasus.** (Abstract.) [*In Russian.*]—*Veterinariya* **21** no. 8–9 p. 22. Moscow, 1944.

About 400 adult ticks collected from horses in the North Caucasus included *I*[*xodes*] *ricinus*, L., *D*[*ermacentor*] *marginatus*, Sulz., *D. silvarum*, Olen., *D. niveus*, Neum., *H*[*aemaphysalis cinnabarina* var.] *punctata*, C. & F., and *H*[*yalomma*] *marginatum*, Koch. The last two were found in a stable in January, and ten horses in it became infected with *Nuttallia* [*equi*] in the same month. This indicates that ticks may infect horses in stables in the cold seasons of the year.

[Potemkin (V. I.) & Vedernikov (N. T.).] **Потемкин (В. И.) и Ведерников (Н. Т.). On the Hypodermatosis of Horses.** [*In Russian.*]—*Veterinariya* **21** no. 8–9 p. 23. Moscow, 1944.

In March and April 1942, the authors examined horses that had been brought to a veterinary hospital from various parts of the Russian Union, and found that 1 per cent. were infested with *Hypoderma bovis*, Deg. All the larvae were in the fourth or fifth instar, there were from one to four per animal and they were found only under the skin of the loins near the spine. These findings and a few records cited from the Russian literature indicate that infestation of horses by *Hypoderma* is less infrequent than is usually supposed.

[Bernadskaya (Z.).] **Бернадская (З.). Waste Autol Oil as a Remedy against Ixodid and Argasid Ticks.** (Abstract.) [*In Russian.*]—*Veterinariya* **21** no. 8–9 p. 44. Moscow, 1944.

In experiments against *Hyalomma savignyi*, Gerv., *Boophilus calcaratus*, Bir., *Argas persicus*, Oken, and *Ornithodoros lahorensis*, Neum., in the laboratory, on animals and in buildings, good results were obtained from the application of used lubricating oil either alone or emulsified with clay or ox-bile ($3\frac{1}{2}$ parts oil and 5 parts clay or 4 parts oil and 4 parts ox-bile to 10 parts water). The Argasids were killed more easily than the Ixodids and unfed examples of *Boophilus* more easily than *Hyalomma*. Though only a few examples of *Hyalomma* were killed when the infested parts on the body of the host were rubbed with the oil, the majority dropped off it. More ticks were killed on parts of the body covered with hair than on hairless ones.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). A Register of the Spirochaetes of Tick Strains of Relapsing Fever in the USSR and neighbouring Countries.** [*In Russian.*]—*Probl. region. Parasit.* **3** pp. 19–35, 9 figs., 12 refs. Moscow, 1939. (Also in English, pp. 35–44.) [Recd. 1945.]

Laboratories in the Russian Union have maintained a number of strains of spirochaetes of tick-borne relapsing fever for years by keeping them in live examples of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.), a method that avoids the expense of repeated passages through guineapigs. The ticks are long-lived [*cf. R.A.E.*, B **31** 162] and have been shown to preserve virulent spirochaetes for 7–8 years, and any strains required for experiment can be obtained by feeding the ticks on guineapigs.

Since the rich collections of spirochaetes already made are continuously being increased by the finding of further batches of spontaneously infected ticks, the author has begun the publication of a series of records of the strains isolated from ticks in the Russian Union and adjacent countries in places where relapsing fever is prevalent. This paper is the first of the series and also contains details of the records desired. Each should include the identity of the

tick, a general geographical description of the place where it was found, with a map, details of the biotope with illustrations, the dates of collection and demonstrations of infectivity of the tick, the species of animal used to demonstrate its infectivity, the pathogenicity of the strain to man, and the names of those responsible for each phase of the work. In this first series, particulars are given relating to ten strains of relapsing-fever spirochaetes isolated from *O. tholozani* in Tadzhikistan and southern Kirghizia.

[Pavlovskiĭ (E. N.) & Aluimov (A. Ya.).] **Павловский (Е. Н.) и Алымов (А. Я.). Tick-borne Relapsing Fever in southern Kirghizia.** [*In Russian.*]—*Probl. region. Parasit.* **3** pp. 72–98, 4 figs. Moscow, 1939. (With a Summary in English.) [Recd. 1945.]

During investigations on tick-borne relapsing fever in the south-western part of the Kirghiz Republic in July and August 1935, many engorged and unfed nymphs and adults of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) were found in several neighbouring districts in artificial caves in which grain was stored or sheep were kept in winter, in burrows of rodents and tortoises, and in holes inhabited by birds, and engorged females had previously been taken in a house [*R.A.E.*, B **19** 255]. Ticks from a porcupine burrow and burrows of *Meriones erythrourus* transmitted spirochaetes to guineapigs on which they were fed. No natural infection was found in small rodents taken in one of the districts, but an example of *M. erythrourus* was experimentally infected with a strain of spirochaetes isolated from ticks, which suggests that this gerbille may be a local reservoir.

Most of the local cases of relapsing fever were evidently tick-borne, since the blood of the patients was infective to guineapigs. The disease occurred almost exclusively in spring and summer, and a man was experimentally infected with it by the feeding of a batch of *O. tholozani* taken in one of the caves.

Experiments with several strains of relapsing fever spirochaetes from various parts of Central Asia showed that they could not be differentiated by the character of the disease they produced in guineapigs or, with any reliability, by cross-immunity tests.

Unti (O.) & [da] S[ilva] Ramos (A.). **Sobre a fauna anofélica do Vale do Paraiba (Diptera—Culicidae).** [On the Anopheline Fauna of the Paraiba Valley.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 21–34, 5 figs., 15 refs. São Paulo, 1943.

Records are given of the Anophelines taken in 19 localities in and around the Paraiba Valley in São Paulo, where malaria does not occur, with notes on the morphology of various stages and the breeding places of some of them. They comprised *Anopheles* (*Nyssorhynchus*) *albitarsis*, Arrib., *A.* (*N.*) *argyritarsis*, R.-D., *A.* (*N.*) *pessôai*, Galvão & Lane, *A.* (*N.*) *strodei*, Root, *A.* (*N.*) *triannulatus*, Neiva & Pinto, *A.* (*N.*) *lanei*, Galvão & Amaral, *A.* (*N.*) *noroestensis*, Galvão & Lane, *A.* (*A.*) *peryassui*, D. & K., *A.* (*A.*) *maculipes*, Theo., *A.* (*Myzorhynchella*) *lutzi*, Cruz, *A.* (*M.*) *parvus*, Chagas, *A.* (*M.*) *antunesi*, Galvão & Amaral, *A.* (*Kerteszia*) *cruzi*, D. & K., and *Chagasia fajardoi*, Lutz. *A. albitarsis* constituted 80 per cent. of the Anopheline population and bred in the lowlands close to the river. The only species taken in houses were *A. albitarsis*, *A. triannulatus* and *A. lanei*. *A. albitarsis*, *A. strodei* and *A. noroestensis* attacked man and domestic animals equally readily in the open, while *A. argyritarsis*, *A. triannulatus*, *A. peryassui*, *A. maculipes*, *A. lutzi* and *C. fajardoi* were attracted to animals. *A. cruzi*, which occurred only in the mountain forests surrounding the valley, attacked man avidly.

Ayroza Galvão (A. L.), Lane (J.) & Unti (O.). **Sobre o *Anopheles noroestensis* Galvão e Lane, 1938.** [On *A. noroestensis*.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 35–48, 6 figs., 10 refs. São Paulo, 1943. (With a Summary in English.)

The authors conclude from a study of type material that *Anopheles ayrozai*, Unti, is a synonym of *A. noroestensis*, Galvão & Lane [*cf. R.A.E.*, B **32** 91], and describe the female, male genitalia, egg, larva and pupa of this Anopheline. They suggest in a footnote that *A. clarki*, Komp, may also prove a synonym of it. They also state that the species erroneously considered to be *noroestensis* by Galvão [*cf. loc. cit.*] has recently been described as *A. galvãoi* by Causey, Deane & Deane. Characters distinguishing *A. oswaldoi*, Peryassú, *A. konderi*, Galvão & Damasceno, *A. goeldii*, Rozeboom & Gabaldon, *A. nuñez-tovari*, Gabaldon, *A. rangeli*, Gabaldon, Cova-García & López, *A. emilianus*, Komp (*tarsimaculatus*, auct.), *A. triannulatus*, Neiva & Pinto, *A. strodei*, Root, and *A. galvãoi* from *A. noroestensis* are briefly discussed. It occurs in the States of São Paulo, Rio de Janeiro and Santa Catarina in Brazil, and specimens have also been received from the Province of Tucumán, Argentina. It is not greatly attracted to man.

[da] S[ilva] Ramos (A.). **Observações sobre os anofelinos do Litoral Paulista *Anopheles* (*Nyssorhynchus*) *tarsimaculatus* (Goeldi, 1905) *Anopheles* (*Nyssorhynchus*) *oswaldoi* (Peryassú, 1922).** [Observations on the Anophelines of the São Paulo Littoral.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 49–62, 8 figs., 21 refs. São Paulo, 1943. (With a Summary in English.)

The author summarises published records of Anophelines from the coastal region of São Paulo, Brazil, and gives notes on observations there, mostly in 1942, on *Anopheles oswaldoi*, Peryassú, and *A. emilianus*, Komp, for which he uses the name *tarsimaculatus*, Goeldi, in accordance with the views of Ayroza Galvão [*cf. R.A.E.*, B **32** 91].

These two Anophelines were abundant and frequently occurred in the same breeding places. Notes on the physical and chemical characters and flora of several of these are given. They were frequently close to dwelling houses, but *A. oswaldoi* was rarely taken in the latter, though it attacked domestic animals. *A. emilianus* was numerous in houses, and of 324 females taken in them in March–June 1943 and dissected, 27 contained malaria parasites.

Both Anophelines were bred in the laboratory, though few adults were obtained from eggs deposited there by females taken in nature. The development of *A. oswaldoi* was completed in 20 days at 24–25°C. [75·2–77°F.] and that of *A. emilianus* in 18 days in one series and 20 days in another at 20–25°C. [68–77°F.]. Some females of both species oviposited more than once, and the maximum number of eggs per batch was 180 for each.

Unti (O.). **Resistência de ovos de algumas anofelinas de S. Paulo.** [The Resistance of the Eggs of some Anophelines of São Paulo.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 63–72. São Paulo, 1943. (With a Summary in English.)

The author reviews the literature on the resistance of mosquito eggs to desiccation, quotes an account by Carvalho Franco of his discovery in 1937 that the swarms of *Aëdes scapularis*, Rond., that occasionally occur in Santos are due to delayed hatching caused by dry weather, and describes observations on the effect of deiccation on the eggs of certain Anophelines of the Paraiba Valley, São Paulo. In laboratory tests, the eggs of *Anopheles albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. pessôai*, Galvão & Lane, *A. noroestensis*, Galvão & Lane, and *A. strodei*, Root, kept on moist or dry filter paper for 2–3 days, hatched almost immediately when transferred to water. Eggs laid in winter and kept on moist filter paper survived for up to 15 days. When the eggs were allowed to remain in water for several days before being subjected to desiccation, the

proportion that subsequently hatched varied inversely with the duration of such preliminary treatment.

In further tests, eggs of *A. albitarsis*, *A. noroestensis* and *A. strodei* obtained in the laboratory were placed on the inner sides of vessels lined with damp earth from natural breeding places and exposed to normal temperature and insolation in the open. From 4 to 15 days later, rain water was added to successive vessels, so that the eggs were covered. The vessels were then observed for larvae. The results are given in a table and show that the maximum survival of eggs was 15 days (the duration of the experiment) in winter and 13 in summer, both for *A. albitarsis*. Eggs of the other species survived for up to 9–13 days.

UNTI (O.). **Oxigênio dos focos de anofeles de São Paulo.** [Oxygen in the Breeding Places of *Anopheles* in São Paulo.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 83–102, 4 figs., 9 refs. São Paulo, 1943. (With a Summary in English.)

After a brief discussion of the factors that affect the oxygen content of natural waters, and a detailed account of Winkler's iodometric method of determining this content, as modified by Alsterberg, showing the chemical reactions involved, the author describes laboratory experiments on the effect on the larvae of certain Anophelines of the *Nyssorhynchus* group of reducing the oxygen content of the water in which they were kept. When the oxygen content of water from Anopheline breeding places (5–7 parts per million) was reduced slowly, fourth-instar larvae of *Anopheles argyritarsis*, R.-D., died when it fell to 3–4 p.p.m., and those of *A. albitarsis*, Arrib., *A. strodei*, Root, and *A. noroestensis*, Galvão & Lane, when it reached 1·5 p.p.m. Larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) were not affected by these reductions. In water that had been boiled and thus contained no oxygen, Anopheline larvae died in 15–45 minutes. Food for the larvae was supplied in all these tests.

In natural breeding places, the oxygen content was found, by a sampling technique that is described, to be 2·5–6 p.p.m. for *A. albitarsis*, *A. pessôai*, Galvão & Lane, *A. strodei* and *A. noroestensis*, and 6·5 9·5 p.p.m. for *A. lanei*, Galvão & Amaral, *A. argyritarsis*, *A. darlingi*, Root, *A. parvus*, Chagas, *A. lutzi*, Cruz, and *A. antunesi*, Galvão & Amaral.

It is concluded that Anopheline larvae have definite requirements as to dissolved oxygen, which influences them directly and not, as has been suggested, through its effect on their food-supply, and that control of the larvae by pollution of their breeding places with vegetable refuse, which decreases the supply of dissolved oxygen [*cf. R.A.E.*, B **25** 46, etc.], is justified in some cases.

UNTI (O.). **Ferro dos criadouros de anófeles e o anofelismo sem malária do Vale do Paraíba.** [Iron in the Breeding Places of *Anopheles* and the Problem of Anophelines without Malaria in the Paraiba Valley.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 103–117. São Paulo, 1943. (With a Summary in English.)

In view of the popular belief that the absence of malaria in the Paraiba Valley, São Paulo, is due to the high iron content of the waters in which the local Anophelines breed, the author analysed water from many breeding places there and in districts of São Paulo in which malaria is prevalent. The methods used are described. The results showed that the iron content of water in the valley did not differ materially from that in the malarious districts and was indeed lower than in some of these.

CORRÊA (R. R.). **Os vetores de malária no Estado de São Paulo.** [The Vectors of Malaria in the State of São Paulo.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 119–132, 20 figs., 26 refs. São Paulo, 1943. (With a Summary in English.)

The vectors of malaria in the State of São Paulo are *Anopheles* (*Nyssorhynchus*) *darlingi*, Root, a species [*A. emilianus*, Komp] for which the author uses

the name *A.* (*N.*) *tarsimaculatus*, Goeldi, and which was described by Ramos in 1942 as *A. oswaldoi guarujaensis* [*R.A.E.*, B **31** 141], *A.* (*N.*) *strodei*, Root, *A.* (*N.*) *albitarsis*, Arrib., *A.* (*N.*) *noroestensis*, Galvão & Lane, and *A.* (*Kerteszia*) *cruzi*, D. & K., all of which have been found naturally infected there. Brief notes on their habits are given, almost entirely from the literature. As regards malaria, the State can be divided into four zones. These are the coastal lowlands, where the principal vector is *A. emilianus*, which breeds in brackish waters, does not migrate far from them and maintains the disease in an endemic form ; the malarious plateau region, where the chief vector is *A. darlingi*, which breeds along the rivers, is migratory in habit, and maintains epidemic malaria ; the valley of the southern Paraiba, which is free from the disease, probably owing to the absence of *A. darlingi* and *A. emilianus* ; and the forest region known as " serra do mar," where malaria is transmitted by *A. noroestensis* and *A. cruzi*, which breeds in arboricolous bromeliads and attacks man readily.

Corrêa (R. R.) & [da] S[ilva] Ramos (A.). **Nota sistemática sobre** *Anopheles* (*N.*) *rondoni* **(Neiva & Pinto, 1922). Descrição do ovo (Diptera, Culicidae).** [Systematic Note on *A. rondoni*. Description of the Egg.]—*Arq. Hig. Saude públ.* **8** no. 19 pp. 133–137, 2 figs., 7 refs. São Paulo, 1943. (With a Summary in English.)

The authors briefly describe characters distinguishing the adults of both sexes and larva of *Anopheles rondoni*, Neiva & Pinto, from those of *A. strodei*, Root, and give a description of the egg of the former. The material used came from the State of São Paulo, Brazil.

Fellton (H. L.). **The Breeding of the Salt-marsh Mosquito in midwestern States.**—*J. econ. Ent.* **37** no. 2 pp. 245–247, 5 refs. Menasha, Wis., 1944.

During 1941, the author investigated the occurrence in numbers of *Aëdes sollicitans*, Wlk., at two places in Illinois and one in Indiana, where breeding of a salt-marsh mosquito would hardly be expected. Troublesome outbreaks of this species occurred at one of these places in 1941 and at another in 1940, 1941 and 1942. In each of the three places, it was found to be breeding in areas that were intermittently flooded with salt water, in one case from a swimming pool and in others from oil wells. The swimming-pool water in a marsh and ditch in which the larvae were found had pH values of 7·2 and 8·2 and chloride contents of 6,800 and 8,800 parts per million. The larvae showed a surprising tolerance for acid water at another place in Illinois, where they were found in a pond into which flowed acid mine waste from a shaft coal mine. The acidity of the water was 850 parts per million and the pH was 2·7.

Aëdes dorsalis, Mg., was also present in numbers in Illinois in one swampy area flooded with salt water from oil wells.

Madden (A. H.), Lindquist (A. W.) & Knipling (E. F.). **Tests of Repellents against Chiggers.**—*J. econ. Ent.* **37** no. 2 pp. 283–286, 3 refs. Menasha, Wis., 1944.

The results are given of investigations of repellents for chigger-mites made in Florida in 1942 to develop an effective treatment for use by the armed forces in the prevention of chigger attack. The prevalent species in the area was *Trombicula* (*Acariscus*) *masoni*, Ewing, but several tests were made against *T.* (*Eutrombicula*) *tropica*, Ewing, and the best treatments were shown to be equally effective against *T.* (*E.*) *alfreddugèsi*, Oudm., in Texas. Those tested included powders, liquids and ointments applied to the skin, but treatment of the clothing with liquids proved to be the most effective and gave the longest protection, even when the men were seated or lying on the ground in heavily infested areas. The most practical method of treating the clothing is to apply

the liquid from a small-mouthed bottle in a half-inch band round the inside of all openings of the trousers and the cuffs, fly and neck of the shirt and in a wide band round the upper parts of the socks. Good protection for 30 days was afforded by treatment with 25 per cent. solutions of dimethyl phthalate in benzene or indalone (n-butyl mesityl oxide oxalate) or Rutgers 612 (2-ethyl-hexanediol-1,3) in a petroleum distillate or with undiluted dimethyl phthalate ; the solutions sometimes gave complete protection for 39 days, and the pure dibutyl phthalate for 59. The latter is preferred for practical reasons, including cheapness and availability.

PLUMB (G. H.). *Lethane 384 Special* **for Control of the Brown Dog Tick.**—*J. econ. Ent.* **37** no. 2 pp. 292–293, 3 refs. Menasha, Wis., 1944.

Lethane 384 Special is a combination of n-butyl carbitol thiocyanate and beta-thiocyanoethyl esters of higher fatty acids [in a refined kerosene base (*cf. R.A.E.*, B **31** 167, 205)]. A dust containing 5 gm. with 2 gm. magnesium carbonate and 100 gm. pyrophyllite (Pyrax ABB) was prepared with a view to its use against *Rhipicephalus sanguineus*, Latr., on dogs and in a house in Connecticut. In a laboratory test, examples of this tick were placed in a box with a little of this dust, and the dust was shaken so that they were uniformly coated. They included unfed larvae and unfed, slightly engorged and ovipositing adults, all of which were dead in 24 hours, and two engorged nymphs which were alive after five days. These nymphs were dusted again and the excess dust was removed from the box ; they died three and five days later. As dust had been left in the box for part of the test, it was just possible that a fumigant action might have been involved. That it was not was indicated by another experiment, in which unfed larvae died in six hours after being dusted and transferred to a clean open container.

A dust containing 5 per cent. tetraethyl thiuram disulphide and one containing 10 per cent. tetramethyl thiuram disulphide were also tested on unfed larvae, but were not effective.

SABROSKY (C. W.). **A Malaria Mosquito Survey of southern Michigan.**—*J. econ. Ent.* **37** no. 2 pp. 312–313. Menasha, Wis., 1944.

Malaria was very prevalent in Michigan in pioneer times, but the annual number of cases is now only about 70 for the entire State. War conditions, however, including the influx of labour from the south, the return of invalided military personnel, and congested industrial areas, might lead to a serious increase in the disease, and an Anopheline survey of the southern and most populous part of the State was therefore carried out from late July to early September in 1943.

Anophelines were found to be abundant and widely distributed, and were breeding in 419 of the 624 places that were surveyed for larvae. Of the four species known to occur in the State, *Anopheles quadrimaculatus*, Say, *A. punctipennis*, Say, and *A. walkeri*, Theo., represented approximately 75, 20 and 5 per cent. of the larvae identified ; *A. maculipennis* var. *occidentalis*, D. & K., was found only in the adult stage and only near the northern limits of the survey. The prevalence of *A. quadrimaculatus*, which is the chief malaria vector of the eastern United States, was unexpected, as Michigan appears to be the northern limit of its range. It was breeding in 352 of the places in which Anopheline larvae were found, and occurred quite frequently in running water that would not ordinarily be considered suitable for it. Of the breeding places classified as running and standing water 67·6 and 91·6 per cent., respectively, contained *A. quadrimaculatus* and 63·9 and 16·1 per cent. contained *A. punctipennis*, the species to be expected in running water. *A. quadrimaculatus* occurred in association with *A. punctipennis* or *A. walkeri* in 33 per cent. of its breeding places, and with both in six of them.

LAAKE (E. W.). **Screwworm Survey in the western Area of the United States in 1943.**—*J. econ. Ent.* **37** no. 2 p. 319. Menasha, Wis., 1944.

A severe drought early in 1943 in the south-west of the United States resulted in the movement of several hundred thousand animals, principally cattle, to northern grazing areas 4–6 weeks earlier than usual. Owing to their unusually early movement from areas infested with the screw-worm [*Cochliomyia hominivorax*, Coq.] to uninfested areas in which climatic conditions were favourable for its development and spread, outbreaks were expected over large areas in which many livestock owners were unfamiliar with it [*cf. R.A.E.*, B **25** 83]. There was further danger of a widespread outbreak later in the season as a result of the development of large populations of flies in the south-west, where there was a shortage of labour and materials for control.

A survey made to determine the extent and intensity of infestation in the western United States and the amount of insecticide needed immediately for control showed that the spread in 1943 was one of the greatest ever recorded in this area. By 1st June, most of Texas and the southern portions of Oklahoma, New Mexico, Arizona and California were infested as a result of normal migration of the fly from the overwintering areas, and later migration resulted in its spread to most of Louisiana, Arkansas, Missouri, Kansas, Oklahoma, New Mexico and Arizona and to the southern parts of Nevada, Colorado, Nebraska and probably Iowa and Illinois. Beyond this area numerous isolated infestations occurred in Nebraska, Iowa, Minnesota, Wisconsin, Illinois and Indiana. The infestations in the more northern States were generally light, but heavy infestations were encountered in different parts of practically every State, and investigation of these always revealed that southern animals had been imported early in the season.

In the more northern States, some of the isolated infestations were promptly controlled or eliminated by the use of Smear 62 [a dressing in which the main ingredients are diphenylamine and benzene (*cf.* **30** 195)]. Additional centres were established for the manufacture of this mixture and its distribution in each of the affected States, large numbers of animals were saved by its use, and the educational value of the control programme is expected to yield even further benefit in future years.

ARCHER (A. F.). **The Ticks of central Tennessee.**—*J. Ala. Acad. Sci.* **16** p. 25. University, Ala., 1944.

Records are given of the local distribution of the ticks found by the author in central Tennessee in 1943. They comprised *Amblyomma americanum*, L., on man, cattle, dogs and sheep, *Dermacentor variabilis*, Say, on man and dogs, *Haemaphysalis leporis-palustris*, Pack., on rabbits and *Argas persicus*, Oken, which was found under loose bark of trees used by roosting fowls. Rocky Mountain spotted fever and tularaemia have recently become of some importance in central Tennessee, and *Amblyomma americanum* is the species chiefly responsible for their transmission there. It represented 90 per cent. of all the ticks found by the author, though *D. variabilis* was more widely distributed.

KOUTZ (F. R.). **Recent Observations on Parasites in small Animals.**—*J. Amer. vet. med. Ass.* **104** no. 805 pp. 199–203, 1 ref. Chicago, Ill., 1944.

This paper, which deals principally with internal parasites of dogs and cats in Ohio, includes notes on the increasing prevalence of *Rhipicephalus sanguineus*, Latr., and *Dermacentor variabilis*, Say, on dogs [*cf. R.A.E.*, B **31** 5–6]. The lice found on dogs are *Heterodoxus longitarsus*, Piag., which was first recorded in the State in 1942, and *Trichodectes canis*, Deg., and *Linognathus setosus*, Olf. (*piliferus*, Burm.), which are common.

Schnelle (G. B.) & Jones (T. C.). **Occurrence of the Cereal Mite in War Dogs.**—*J. Amer. vet. med. Ass.* **104** no. 805 pp. 213–214, 2 figs., 4 refs. Chicago, Ill., 1944.

Numerous eggs and immature forms and a few gravid females of a species of *Tyroglyphus* were found in the faeces of a dog during routine examination in a veterinary hospital in Virginia. The dogs in the hospital had been fed on the previous morning on well cooked rolled oats, which in the dry state contained large numbers of mature mites. On the second day, faeces of three other dogs were found to contain numerous immature mites and eggs. Eggs and mites were found in the faeces of the four dogs on the third day, but all were negative on the fourth. At no time was there evidence of disturbed digestion or other illness attributable to the mites.

Sanders (D. A.). **Mastitis in Heifers following Injury by the Horn Fly,** *Haematobia serrata* **Desv.**—*J. Amer. vet. med. Ass.* **104** no. 806 pp. 284–285, 1 fig., 3 refs. Chicago, Ill., 1944.

Cases of mastitis in first-calf heifers reared on the range or apart from older animals in Florida were thought to be attributable to infection, when they were calves, of lesions on the udder caused by *Lyperosia irritans*, L. (*Haematobia serrata*, R.-D.). Frequent puncturing of the skin by the fly resulted in the formation of large plaque-like lesions on the body and serious injury was often caused by the sucking of blood from the teats and adjoining surface of the udder of young heifer calves. Bacteriological cultures from the surface of lesions on the udder and from the abnormal udder secretions that resulted from the injury showed the presence of staphylococci, micrococci, diplococci and streptococci. The acute surface lesions disappeared as the animals became of breeding age, but the micro-organisms often became permanently established within the udder and caused serious injury to the secreting tissues at the time of calving. As mastitis in first-calf heifers ceased to be of economic importance on one dairy farm following the control of *L. irritans*, it is concluded that it had been responsible for infection.

Hartzell (A.). **Further Tests on Plant Products for insecticidal Properties.**—*Contr. Boyce Thompson Inst.* **13** no. 5 pp. 243–252, 1 fig., 24 refs. Menasha, Wis., 1944.

The author describes further investigations on the insecticidal properties of extracts of some 125 species and varieties of plants and of three isolated toxins derived from plants [*cf. R.A.E.*, A **30** 286]. Plants known to contain substances poisonous to man were avoided, with a few exceptions, as it was hoped to find toxins specific to insects. The median lethal doses of acetone extracts of the plants to larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) are shown in four tables. They were 24 and 29 parts per million for berries of *Piper cubeba* and dried berries of *P. nigrum* and between 245 and 520 p.p.m. for the nine plants next in order of toxicity. None of these plants gave kills within this dosage range when extracted with water. It is pointed out that ten of the extracts were obtained from the flowers or fruiting parts of the plants and that the eleven species are distributed in eight families. Plants that contain substances toxic to mosquito larvae are widely distributed throughout the world, and if serious shortages of standard larvicides should occur, it may be possible to use local products as substitutes.

Acetone extracts of some of the plants were tested as contact insecticides against *Aphis rumicis*, L., and as stomach poisons against *Epilachna varivestis*, Muls., but the results were unsatisfactory.

Hartzell (A.) & Strong (M.). **Histological Effects of Piperine on the central nervous System of the Housefly.**—*Contr. Boyce Thompson Inst.* **13** no. 5 pp. 253–257, 2 figs., 6 refs. Menasha, Wis., 1944.

The following is from the authors' introduction and summary. Piperine, the alkaloid in the dried fruit of *Piper nigrum*, has proved to be more toxic to *Musca domestica*, L., than pyrethrum when tested in fly sprays [*R.A.E.*, B **32** 73], but, except at high concentrations, lacks the property of quick knockdown characteristic of the latter. In a preliminary histological study it was found to have distinct and characteristic effects on the central nervous system and associated muscles of the fly. Its foremost effect was the destruction of the fibre tracts and vacuolisation of the nerve tissue of the brain, but it did not show the widespread clumping effect on the chromatin of the nuclei characteristic of pyrethrum [**31** 49].

Smith (M. G.), Blattner (R. J.) & Heys (F. M.). **The Isolation of the St. Louis Encephalitis Virus from Chicken Mites** (*Dermanyssus gallinae*) **in Nature.**—*Science* **100** no. 2599 pp. 362–363, 10 refs. Lancaster, Pa., 1944.

The sporadic occurrence of a few cases of St. Louis encephalitis in man in St. Louis County (Missouri) since the epidemic in 1937 indicates the existence of an endemic focus. It has been shown that mosquitos carry the virus in nature and transmit it from and to fowls [*cf.* *R.A.E.*, B **32** 129, etc.], but the demonstration of neutralising antibody in young fowls in an area in which it was not apparent in man suggested that fowls were being infected by a vector that does not attack man, possibly by *Dermanyssus gallinae*, Deg., which is common on them in this area. Details are given of experiments in which a virus was isolated from examples of this mite by inoculation and sub-inoculation in mice and was identified as that of St. Louis encephalitis. The mites used were obtained from fowls of which some had neutralising antibody in their sera, and they were starved for one or four weeks before the inoculum was prepared from them.

Yeager (J. F.) & Munson (S. C.). **Relation of Dosage to Survival Time of Arsenite-injected Roaches.**—*Science* **100** no. 2605 pp. 501–503, 1 graph. Lancaster, Pa., 1944.

In experiments carried out for several years on the mode of action of sodium metarsenite on *Periplaneta americana*, L., various concentrations of the poison in volumes of saline proportional to the body weight were injected into the insects and the survival times were determined. When survival times were plotted against concentrations, hyperbolic curves characterised by a critical zone and a region of inflection were obtained. The critical zone is a region, usually associated with long survival times, in which insects receiving equal doses of the poison have survival times that fall into a bimodal frequency distribution or actually into two separate groups, and the region of inflection is one in which slightly different concentrations of the poison may cause the same survival time, or the lower dosage may cause the shorter survival time.

The authors explain the latter anomaly by the effect of dissociation on the mode of action of the poison. They postulate that the toxic action depends on the degree of ionisation of the compound ; that the arsenical ion thus formed, or a secondary material dependent on its formation, combines with certain vital tissue components in a fundamental lethal reaction ; and that the death of the insect is a result of a certain minimum quantity of the arsenic combining with a unit quantity of the tissue component. Equations are evolved in which the influence of dissociation is taken into account ; survival times calculated by these agree well with observed survival times even in the region of inflection.

It is considered that these equations are of general applicability in studies involving the action of compounds, such as sodium metarsenite, that exist in

solution in two different forms in a condition of equilibrium. The good agreements obtained by their use support the underlying hypothesis and indicate that the effective concentration is not necessarily the concentration of the poison that is injected into the insect, and that the anomaly represented by the region of inflection is the result of variations in the degree of dissociation at different concentrations.

[**Papers on Mosquito Control.**]—*Mosq. News* **4** no. 2 pp. 48–61, 3 figs. New Brunswick, N. J., 1944.

These papers comprise **An annotated List of the Mosquitoes of Virginia** by R. E. Dover, W. E. Bickley & H. P. Nicholson (pp. 48–50), **References to Literature of Interest to Mosquito Control Workers by** H. H. Stage (pp. 55–61), and **Simple Field and Laboratory Tests of Larvicides** by H. L. Fellton (pp. 50–54), 3 figs., 5 refs. The last one deals with easy methods of estimating the effectiveness of oils and Paris green dusts. The relative toxicities of various Paris green dusts to Anopheline larvae may be judged by placing a larva in a petri dish containing water and adding a small amount of Paris green. When the larva has ingested a small particle, it is removed by pipette to a second dish, washed and put into a third where the time of its survival is noted. If ten or more second-, third- and fourth-instar larvae are put into a pan partly filled with water, and a mixture of the Paris green and diluent is dusted over the surface at the rate to be used in the field, control should be complete within two hours if the treatment is to be effective. An effective field dose may be determined by sampling the population of Anopheline larvae at specific points in breeding areas before and the day after the application of known dosages of the larvicide. The dosage tried should be gradually increased until it is found to be effective. Another method is to place dishes partly filled with water and containing a known number of larvae at various points in the breeding area before treatment and determining the percentage mortality after dusting.

The specifications of a good larvicidal oil are given [*R.A.E.*, B **32** 129] and also notes on methods of determining the toxicity of certain oils to mosquito larvae, including one from a paper already noticed [**31** 23], and of ascertaining whether the spreading coefficient, specific gravity and viscosity are satisfactory. The simplest way of determining the toxicity of an oil is to place 10–50 larvae and some pupae in a container partly filled with water and apply a thin film of oil. The time elapsing before the larvae and pupae are dead or failure to kill them indicates the relative toxicity. Another method is to place the larvae and pupae in a tall glass cylinder two inches or less in diameter filled with clean water almost to the top, cover the water with a film of the oil to be tested and leave it for 30 seconds, and then introduce fresh water into the bottom of the cylinder through a tube to float off the oil, which is absorbed with blotting paper. The larvae and pupae are then transferred to clean water and the time of death observed. The experiment should be repeated, increasing the time of contact by half minutes. If an oil does not kill with a total contact time of five minutes, it is probably not toxic enough to give effective control.

The spreading coefficient of an oil is tested by comparing the spread of a drop on water with that of a drop of castor oil, which has a spreading coefficient of about 16–20 dynes per cm. If the larvicidal oil spreads over as much of the water as the castor oil or more, it is likely to be satisfactory. Viscosity is assessed by comparing the time taken for a given quantity of the oil to flow through a pipette with that taken by the same quantity of a mixture of glycerine (95 per cent. pure) and distilled water (60 : 40 parts by volume) when both are at a temperature of 70°F. As the mixture has a viscosity of 45 S.U. at 100°F., the time taken for the oil to flow through should not exceed that taken by the mixture.

Du Toit (R. M.). **The Transmission of Blue-tongue and Horse-sickness by *Culicoides*.—*Onderstepoort J. vet. Sci.* 19** no. 1–2 pp. 7–16, 2 figs., 14 refs. Pretoria, 1944.

Earlier work on the possible transmission by insects of blue-tongue of sheep [*R.A.E.*, B **22** 171] and horse-sickness [**4** 27; **18** 243; **22** 263; **23** 145; **26** 58] in Africa is reviewed, and an account is given of an investigation on the transmission of both diseases carried out at Onderstepoort during 1942 and 1943. Insects were caught by sweeping and by the use of aspirators on bait animals and of light-traps. The light-traps were modifications of the New Jersey model [**31** 195, etc.] with organdie sides to the cage to retain minute insects, a lid to exclude rain, the inlet tube to the cage extended to allow insects to escape the moving column of air and thus reduce mortality, and the source of light (a 75-watt bulb) placed below the catching cage and the fan above it so that the convection currents assist the draught of the fan and the insects are not caught in the blades. The technique used in handling and storing the insects is briefly described.

Suspensions of various species of mosquitos and of *Culicoides* caught in nature were injected intravenously into susceptible animals, and three typical cases of blue-tongue (one of them fatal) and one of horse-sickness followed injection of *Culicoides* in March, April and May 1943. Blood from the sheep that succumbed, taken during the reaction, produced another fatal case in a susceptible sheep but no reaction in one that had reacted typically 6½ weeks earlier. Blood from the infected horse taken during the reaction produced a fatal reaction in a susceptible horse. Blue-tongue was also once transmitted by the bites of *Culicoides* that had fed on a reacting sheep ten days previously and had then been maintained on sugar solution and fruit juice. The two engorged individuals recovered were identified as *C. pallidipennis*, C., I. & M. Large numbers of *Culicoides* and mosquitos caught at light were fed upon susceptible animals during March, April and May 1943, but the results of these experiments, of which 23 were made for blue-tongue and 15 for horse-sickness, were entirely negative. These findings are discussed.

Mönnig (H. O.) & Cilliers (P. A.). **Sheep Blowfly Research. VII. Investigations in the Cape Winter-rainfall Areas.**—*Onderstepoort J. vet. Sci.* **19** no. 1–2 pp. 71–77, 4 refs. Pretoria, 1944.

The investigations recorded in the first six papers of this series [*R.A.E.*, B **33** 6–9] were made mainly in the summer-rainfall area that constitutes most of South Africa. The present paper deals with investigations carried out between July 1942 and June 1943 in the so-called winter-rainfall area, which comprises the south-western corner of Cape Province and a strip along the southern coast. The rainfall in this area is well distributed throughout the year, the climate is mild and humidity is relatively high. Sheep are therefore attacked by blowflies at all seasons. The investigations showed that *Lucilia cuprina*, Wied., breeds almost exclusively on live sheep throughout the year [*cf.* **33** 8]. It did not breed in sheep carcasses exposed in large troughs as described by Hepburn [**33** 8], and only a few individuals were obtained from four small carcasses in winter. The sheep carcasses produced mainly *Chrysomyia chloropyga*, Wied., during the cooler months and *C. albiceps*, Wied., and *C. marginalis*, Wied., in summer. These flies were not found to infest sheep [*cf.* **33** 6]. The 5,000 maggots that comprised 55 samples examined from sheep from three areas were all *Lucilia* and all those reared to the adult stage were *L. cuprina*. As this species came to meat bait (although it comprised only 6·28 per cent. of the total catch for the year), and *L. sericata*, Mg., bred in small carcasses, it may be that competition by species of *Chrysomyia* is responsible for the usual failure of *Lucilia* spp. to develop in sheep carcasses. The conditions under which *C. chloropyga* infests sheep are briefly discussed. The authors do

not agree with Hepburn's suggestion that high rainfall is responsible [**33** 6], as he found *C. chloropyga* in only two out of 56 samples of maggots from sheep in an area of high rainfall and humidity, although it bred there in large numbers in carcasses in winter. Although no strikes by *C. chloropyga* were found by the authors, they consider it desirable to destroy large carcasses from June to October in the winter-rainfall area so as to control it, and to bury carcasses only about two days after the death of the animal during the rest of the year to encourage *C. marginalis* [*cf.* **33** 8].

Estudios sobre Triatominae.—*Publ. Misión Estud. Pat. reg. argent. Jujuy, Univ. B. Aires* no. 67, 63 pp., 3 col. pls., 48 figs. Buenos Aires, 1944.

This publication comprises seven papers on Argentine Triatomids, the first six of which are by S. Mazza & M. E. Jörg, and the seventh by Mazza only.

In *Triatoma bruchi*, **nova species argentina de Triatominae (Hemiptera—Reduviidae),** pp. 3-11, 7 figs., *Triatoma bruchi*, sp. n., is described from a single male collected in Misiones. In **Sobre** *Triatoma oswaldoi*, **morfología y variación individual,** pp. 12-33, 1 pl., 19 figs., the original description of *Triatoma oswaldoi*, Neiva & Pinto [*R.A.E.*, B **11** 202] is given in Spanish, and the morphological similarity between this species and *T. infestans*, Klug, is discussed. The authors conclude that although it may be difficult to distinguish individuals of the two species, the difference is clear if large numbers of both are examined. A redescription of *T. oswaldoi* and a table of the measurements of three characteristic adults (a male and two females) are given. Very little is known about its habits, apart from the fact that they bear a certain resemblance to those of *T. infestans*. Collections of large numbers of the latter in the walls and roofs of houses usually include a few individuals of *T. oswaldoi*, and unmixed populations of this species were sometimes found. It shows the same preference as *T. infestans* for dwellings as breeding places, and also favours animal quarters and abandoned timber. It is only occasionally found in woodland surroundings.

The redescription of *Triatoma nigromaculata*, Stål, by Lent & Pifano [**28** 172] is given in Spanish in **Sobre** *Triatoma nigromaculata* **(Stål 1872),** pp. 34–46, 1 pl., 10 figs., together with their figure of the female and photographs and a plate prepared by the authors. The measurements of a well preserved female and brief descriptions of nymphs of two instars are also given. In **Sobre una suspecta ninfa de** *Triatoma rosenbuschi*, pp. 47–50, 3 figs., the finding of a melanic nymph, believed to be that of *T. rosenbuschi*, Mazza, is recorded. Attention is called in **Particularidades morfológicas de** *Triatoma sordida*, pp. 51–55, 5 figs., to the difference in size between the sexes of *Triatoma sordida*, Stål, and to the fact that the marking of some individuals is unusually clear. In **Nuevas localidades para** *Triatoma infestans* **en la provincia de Buenos Aires,** pp. 56–61, 1 map, 3 figs., are recorded observations showing that the distribution of *Triatoma infestans*, Klug, is much wider than it was previously known to be. Individuals were found infected with *Trypanosoma* (*Schizotrypanum*) *cruzi* in several localities. In **Sobre la iconografía original de** *Panstrongylus geniculatus* **y** *Triatoma dimidiata* pp. 62–63, 1 pl., the author discusses and reproduces the originals of illustrations of *Panstrongylus geniculatus*, Latr., and *Triatoma dimidiata*, Latr., prepared by Bonpland for the work in which they were described.

PAPERS NOTICED BY TITLE ONLY.

SMART (J.). **A Handbook for the Identification of Insects of Medical Importance.**—Second impression, with minor corrections and new index, 10×7½ ins., x+272 pp., 13 pls. (3 col.), 178 figs., refs. London, Brit. Mus. (Nat. Hist.), 1944. Price 15*s*. [*Cf. R.A.E.*, B **31** 247.]

ANDUZE (P. J.) & HECHT (O.). *Aëdes* (*Finlaya*) *upatensis* **sp. nov.** [in Venezuela]. —*Bol. ent. venezolana* **2** no. 4 pp. 185–188, 1 fig. Caracas, 1943. (With a Summary in English.)

HARPER (J. O.). **Notes on the Swarming of Males of *A. funestus* (Giles), in East Africa.**—*E. Afr. med. J.* **21** no. 5 pp. 150–151, 1 ref. Nairobi, 1944.

The following is almost entirely taken from the author's summary. Males of *Anopheles funestus*, Giles, were observed assembling inside the doorway of a thatched dwelling in Central Kavirondo, Kenya Colony, on 18th November 1942. The swarm increased in numbers from about 50–100 to 400–500 between 6.15 p.m. and 6.35 p.m., when the light was failing, and had dispersed or moved elsewhere five minutes later.

DAVIS (W. A.) & WHEELER (C. M.). **The Use of Insecticides on Men artificially infested with Body Lice.**—*Amer. J. Hyg.* **39** no. 2 pp. 163–176, 1 fig. Lancaster, Pa., 1944.

Accounts are given of three experiments carried out in New Hampshire in 1942 on the control of *Pediculus humanus*, L. (*P. h. corporis*, Deg.) on artificially infested human volunteers by treating the clothing with powders or a spray composed of materials that had shown promise in the laboratory. The men wore cotton sleeveless vests and shorts in the first two experiments and vests with sleeves to the elbow and trunks extending to the ankle, both containing 25 per cent. wool, in the third. Just before the underwear was distributed, a cloth patch bearing lice and eggs was sewn into the pants at the small of the back. Each experiment lasted three weeks. The men were instructed not to kill lice intentionally, not to wash or change their underwear or bedding and to wear the underclothes both night and day. They might, however, remove the top during the day whenever they would naturally do so because of heat. They bathed and changed their outer clothing as they pleased. Treatments were made when the louse populations had begun to rise. In the case of powder, 30 gm. was given to each man, who was instructed to spread it all over the underwear and on the armpits and crotch of outer clothing, paying particular attention to seams and folds. The spray was applied from an atomiser while the clothing was held in the air, about 50 ml. being used to cover both sides of the underwear.

The materials compared in the first test, which began on 28th July, were a control dust consisting of 50 per cent. frianite [*cf.* *R.A.E.*, A **32** 208], 35 per cent. talc, 8 per cent. rice flour, 5 per cent. zinc stearate and 2 per cent. boric acid; four dusts containing 0·8 per cent. dinitro-o-cyclohexylphenol (2, 4-dinitro-6-cyclohexylphenol) with or without other active materials in the inert ingredients that formed the control; and two dusts of unrevealed composition, NLE and YAT, supplied by the U.S. Department of Agriculture. All the active powders killed all adult lice present, but none eliminated infestation, because they had no ovicidal effect and did not remain lethal long enough to destroy all the lice as they hatched. All the powders containing dinitro-o-cyclohexylphenol stained the clothing a pale yellow. NLE caused scrotal irritation. YAT caused no trouble and felt pleasanter than the frianite powders.

During the second experiment, which began on 24th August, the materials tested were a dust containing 1·5 per cent. dinitro-o-cyclohexylphenol in pyrophyllite, a similar dust containing also 1 per cent. phenyl cellosolve [ethylene glycol monophenyl ether], one containing 0·7 per cent. dinitro-o-cyclohexylphenol, 0·1 per cent. pyrethrins and 1 per cent. phenyl cellosolve in pyrophyllite, a dust designated MYL [0·2 per cent. pyrethrins, 2 per cent. dinitroanisole, 2 per cent. n-isobutylundecyleneamide and 1 per cent. phenol S (isopropyl cresols) in pyrophyllite] supplied by the U.S. Department of Agriculture and adopted by the U.S. Army for use in the field, the same control dust as in the first experiment, and a spray containing 0·2 per cent. pyrethrins and 29 per cent. phenyl cellosolve in acetone. The dusts containing 1·5 per cent. dinitro-o-cyclohexylphenol rid all men of lice immediately and kept them free for a week, but were not practical as they severely stained the clothing and bodies of the men and irritated the nose. Both the other powders killed all lice present on the

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day of treatment and continued effective. The men who used them were reinfested with 24 lice six days after treatment and most of these died in the next four days. The disadvantages of both powders were slight. MYL caused brief anal itching in two instances. The one containing dinitro-o-cyclohexylphenol produced a transient scrotal rubor in one case and caused yellow staining, so that the other would be preferred. The spray was the least effective agent used and took longest to apply.

The control used in the third experiment, which began on 22nd September, consisted of 80 per cent. pyrophyllite with 20 per cent. flowers of sulphur to give a yellow colour. It definitely decreased louse populations for five days. A powder composed of 2 per cent. dinitroanisole and 2 per cent. n-isobutylundecyleneamide in pyrophyllite, which is known to be an ovicide in the laboratory, did not prevent eggs from hatching in this test, but was as effective against lice as the powders used in the first experiment. A second application made six days after the first destroyed the remaining lice. A powder consisting of 0·4 per cent. dinitro-o-cyclohexylphenol and 1 per cent. n-isobutylundecyleneamide in pyrophyllite was similar in effect to the dinitro powders used in the first experiment, and it was concluded that, given an efficient carrier, the concentration of the insecticide is the significant factor. Good results with MYL and with a powder containing 0·6 per cent. dinitro-o-cyclohexylphenol, 0·1 per cent. pyrethrins and 0·5 per cent. n-isobutylundecyleneamide in pyrophyllite confirmed the results of the previous experiment. Both killed all lice present at the time of application and all that hatched for at least ten days. They were partly active against lice put on the men six days after treatment. Comparison of the results obtained with the powder of known composition with those of the earlier experiments and with those obtained with a dust containing the same ingredients in smaller quantities gave confirmation that the concentration of insecticide was the most significant factor in the lasting power of a powder. Effective doses of dinitro-o-cyclohexylphenol stained skin and clothing too severely, and effective doses of pyrethrins would be too sticky because commercial pyrethrum concentrates are 80 per cent. oil. The best powders of known composition for practical purposes were those that contained both these ingredients near their practical limit of concentration. Effectiveness did not correspond with speed of action in the laboratory. Powders are considered preferable to sprays or impregnation because they do not need special equipment, clothes can be put on as soon as they have been treated, and the powder drifts into seams and creases more thoroughly than a spray can be driven in.

Davis (W. A.), Malo Juvera (F.) & Hernandez Lira (P.). **Studies on Louse Control in a civilian Population.**—*Amer. J. Hyg.* **39** no. 2 pp. 177–188. Lancaster, Pa., 1944.

The object of the work described in this paper was to study the possibility of exterminating lice [*Pediculus humanus*, L., and *P. h. capitis*, Deg.] among whole groups of civilians by treating the hair of every member of the group with lotion to destroy lice and eggs and their underwear with powder to destroy lice. Four tests were made in 1943 in five Mexican villages, two of which were dealt with as a unit. The populations concerned ranged from 109 to 687. The interest and co-operation of the people were first obtained, a map of the place was then prepared showing every house, and a census was taken of the whole population. A qualified man or woman then examined each person, recorded whether head and clothing were infested or not, and treated them. A week later, clothing was re-examined and retreated. Results were again examined in later weeks. The lotion used consisted of phenyl cellosolve, ethanol and water (1 : 2 : 2) with enough methyl salicylate to give a slight pleasant odour. Results with it were not fully evaluated, but it is thought to have been completely effective. In one of the experiments, a powder composed of 0·2 per cent. 2, 4-dinitro-butylphenol and 1 per cent. light mineral oil in Pyrax ABB [pyrophyllite] was used,

and on this occasion the percentage of persons with infested clothing was not reduced below 32, though actual numbers of lice fell drastically. In another test, this powder was used for the first treatment and one containing 0·1 per cent. pyrethrins, 0·5 per cent. n-isobutylundecyleneamide and 0·6 per cent. dinitro-o-cyclohexylphenol in the same base was used for the second. Results were completely unsatisfactory, probably on account of the conditions of the experiment. Rough tests with *P. humanus*, *P. h. capitis* and fleas from man indicated that the second powder is effective if properly used. The two remaining experiments were made with MYL [see preceding abstract]. In the first, where living conditions favoured the spread of lice within the family, it was applied by hand and the percentage of persons with infested clothes was reduced from 79 to 5·6. In the other, it was applied through blowers consisting of flexible tubes operated by compression, and control was practically complete. This village was chosen because a mild typhus epidemic had broken out there. The percentage of persons with infested clothes was 64. The epidemic ceased suddenly eight days after treatment began. The necessary equipment and its cost and directions for the field workers are given in appendices.

Lunn (H. F.). **Observations on the *Sarcoptes* of Man.**—*Parasitology* **36** no. 1–2 pp. 67–68, 2 figs., 4 refs. London, 1944.

Having studied several hundred females of *Sarcoptes scabiei scabiei*, Deg. (*hominis*, Hering) from man, the author concludes that they differ in only one respect from *S. caballi*, Oudm. (*scabiei equi*, Gerl.), as described by Buxton [*R.A.E.*, B **9** 148]. The difference is in the birth passage, the anatomy of which is discussed with particular reference to the absence, in the individuals examined, of a genital operculum.

The extreme and average measurements of 42 live females at room temperature are given, and the apparent increase in size that results from mounting is shown.

Roy (D. N.) & Ghosh (S. M.). **Studies on the Population of Head-lice, *Pediculus humanus* var. *capitis* De G.**—*Parasitology* **36** no. 1–2 pp. 69–71, 6 refs. London, 1944.

Populations of *Pediculus humanus capitis*, Deg., were studied on 67 infested evacuees from Burma (17 males and 50 females) admitted to a hospital in Calcutta during 1942. The duration of infestation did not exceed three months. The hair was sprayed with a mixture of pyrethrum extract and kerosene, and the dead lice were combed out daily on to towels until all had been removed. Of the 8,702 adult lice collected, 6,671 were females. The average number of adult lice per head was 129·9 and the maximum number on a single head was 1,434 [*cf. R.A.E.*, B **30** 20]. More than 34 per cent. of heads had over 100 adults. Children under 11 years of age were less heavily infested than older people, short-haired individuals more heavily than long-haired ones, and females more than males. Frequent combing of the hair and the use of oil did not seem to dislodge the adults or to prevent the females from laying eggs, but the adult populations on the heads that had been so treated was low. The maximum number of immature lice found on a single head was 4,260 and the average number per head was 418·8. The maximum number of nymphs per adult female was 9 and the average 3·7.

A single treatment with the mixture of kerosene and pyrethrum extract killed all lice and eggs, and reinfestation did not occur, neither did infestation spread to uninfested and untreated people in the same ward. Infested persons were not allowed to wash their hair for 24 hours after treatment, and it is concluded that lice were prevented from re-establishing themselves on treated persons because they do not feed on any part of the body except the scalp and cannot survive for more than 24 hours if prevented from reaching the head.

FROUD (M. D.). *Anopheles jebudensis* **sp. nov., a new Anopheline Mosquito from southern Nigeria.**—*Ann. trop. Med. Parasit.* **38** no. 1 pp. 73–77, 2 figs., 4 refs. Liverpool, 1944.

Descriptions are given of the larva and pupa of *Anopheles jebudensis*, sp. n., from material collected in southern Nigeria and of adults of both sexes bred from it. Larvae were taken in very small collections of water amongst stones in the coarse sandy soil at the edges of seepages from a steep, thickly wooded slope, free from vegetation and exposed to the sun. Some were also found in a shaded ditch at the foot of the seepage where there were a few inches of water above soft mud. They had, however, probably been washed down from the slope. Two larvae of *A. obscurus* var. *nowlini*, Evans, which is not recorded from Nigeria by Edwards [*R.A.E.*, B **29** 115] were also found in the ditch.

RIBBANDS (C. R.). **Differences between** *Anopheles melas* (*A. gambiae* **var.** *melas*) **and** *Anopheles gambiae*. **I.—The larval Pecten.**—*Ann. trop. Med. Parasit.* **38** no. 2 pp. 85–86, 2 figs., 3 refs. Liverpool, 1944. **II.—Salinity Relations of Larvae and Maxillary Palp Banding of adult Females.**—*T.c.* pp. 87–99, 2 figs., 15 refs.

In the first paper, the author gives camera lucida drawings and descriptions of the pectens of the fourth-instar larvae of *Anopheles gambiae*, Giles, and the form hitherto known as *A. gambiae* var. *melas*, Theo. In both cases, the larvae had been reared in fresh water under laboratory conditions. On the basis of the differences between them, of constant differences that have been shown to exist between the eggs and of differences in reaction to salinity [see second paper], he concludes that *melas* is a distinct species. The differences in larval morphology and in reaction to salinity were completely correlated. There were no significant differences between the pectens of larvae reared in fresh water and those of larvae reared in sea water.

Records of the breeding of *A. gambiae* in saline water [*R.A.E.*, B **20** 64, 123–124; **24** 109, 311] are reviewed in the second paper, and an account is given of experiments on this subject carried out in Sierra Leone in 1940, as a result of which it was concluded that the melanic form that breeds in saline water is a distinct species, *A. melas*. The experiments were carried out because it was necessary to station many members of the services near coastal swamps, and the status of the form breeding in salt water was consequently important [*cf.* **30** 87]. The material and methods used are described. Each experiment was made with the product of one batch of eggs from a captured female. It was shown that the maximum concentration of sea water in which *A. gambiae* could develop from egg to adult in the laboratory was 37·5 per cent. (11·9 gm. sodium chloride per litre) and there was little difference between the proportions of eggs that gave rise to larvae that survived in this concentration and in fresh water. *A. melas* could develop completely in 150 per cent. sea water (47·6 gm. sodium chloride per litre), and salinity is therefore unlikely to have any direct deterrent effect on it in nature. Preliminary experiments having indicated that eggs and pupae of both forms were unaffected by high salinities, all detailed experiments were made with larvae. In the combined results of two experiments, only 14 per cent. of fourth-instar larvae of *A. gambiae* and none of the earlier instars survived transfer from fresh water to 50 per cent. sea water. The percentages of larvae of *A. gambiae* that gave rise to adults after transfer to 37·5 per cent. sea water in the first, second, third and fourth instar were 19, 29, 32 and 46. There was no significant difference between the total survival rates of larvae transferred to 25 per cent. sea water and of those left in the fresh water control. Larvae were most resistant towards the end of an instar. Transfer to saline water retarded development. The highest concentration of sea water to which larvae were conditioned by gradual transfer was 60 per cent.

Direct transfer of larvae of *A. melas* of all instars from fresh water to 75 per cent. sea water made no significant difference to the survival rate, and many larvae survived direct transfer from fresh water to 100 per cent. sea water. Larvae of this species can therefore be considered resistant to changes in salinity resulting from tidal action. Larvae of *A. melas* lived to produce adults after gradual transfer from fresh water to 225 per cent. sea water (71·3 gm. sodium chloride per litre). Very high concentrations of sea-water retarded development. Most larvae of both species that died did so within 48 hours of transfer, having become partly incapacitated within 24 hours, and the remainder died at the first moult after transfer. Those that survived a moult could be considered acclimatised. Ability to survive a change in salinity largely depended on the quality and quantity of the food-supply before transfer.

There was no correlation between the proportion of females of *A. melas* with additional dark banding on their palps and the salinity of the water in which they had been reared. There was considerable variation in the quantity of additional dark marking, the quantity being determined genetically. Varying proportions of different families (lots reared from one batch of eggs) were " *melas*-banded " and this is probably true of populations. The limitations to the use of palpal characters for analysing mixed populations of females of the two species are discussed. It is concluded that they may be used to some purpose, when the proportion of " *melas*-banded " individuals characteristic of the local population of *A. melas* is known, but not otherwise. Larvae of the two species may be distinguished by transferring the batches to 37·5 per cent. sea water for one day and then to 75 per cent. for the second day, provided that they are given powdered biscuit or other suitable food. Larvae of *A. gambiae* die before the end of the second day, but those of *A. melas* survive.

David (W. A. L.), Bracey (P.) & Harvey (A.). **Equipment and Method employed in breeding *Aëdes aegypti*, L., for the biological Assay of Insecticides.**—*Bull. ent. Res.* **35** pt. 3 pp. 227–230, 6 refs. London, 1944.

For the testing of sprays to be applied in houses against mosquitos, adults of *Aëdes aegypti*, L., are bred in a small room in which the temperature is maintained at 28±1°C. [82·4±1·8°F.] and the relative humidity at 70±2 per cent. The apparatus employed is described. Three cages of adults are used for oviposition, and the females are given a blood meal on the arm of the operator every third day, the cages being taken in rotation. The eggs, which are laid on tap water in petri dishes about three days after the blood meal, are collected on filter paper each day and stored on damp filter paper for at least four days before being placed in water to hatch. The best food for the larvae is an infusion of bread-crumbs, directions for preparing and supplying which are given. After a week, when emergence begins, the bowls are placed in storage cages for three days, during which lump sugar, raisins and water are supplied for the adults, and then removed. The adult mosquitos, which are 1–4 days old and possessed of their maximum resistance, are then ready for use. It has been found that females fed on sugar or raisins are somewhat more susceptible to sprays than those fed on blood.

Roy (D. N.) & Ghosh (S. M.). **Control of Head and Pubic Lice.**—*Bull. ent. Res.* **35** pt. 3 pp. 231–234, 14 refs. London, 1944.

After summarising the qualities that are desirable in an insecticide for use against *Pediculus humanus*, L., and *Phthirus pubis*, L., and the results obtained by Busvine & Buxton with thiocyanates against *Pediculus humanus capitis*, Deg. [*R.A.E.*, B **30** 99], the authors discuss the results of work in Calcutta, some of which has already been noticed [**30** 1 ; **33** 31] on the control of these lice with pyrethrum.

Against *P. h. capitis*, the hair is sprayed by means of an atomiser with a solution of pyrethrum extract in kerosene containing 0·12 per cent. pyrethrins, which is thoroughly rubbed in, a towel being held before the face, though pyrethrum is not irritating to the eyes. For those about to return to clean surroundings, the hair may be washed an hour after treatment, otherwise the insecticide should be allowed to remain on the hair for 24 hours, during which reinfestation of the head from bedding, etc., does not take place. Of 124 cases of both sexes that received this treatment in hospital and remained there for at least a further fortnight, none showed infestation by lice or eggs on leaving. Of 85 out-patients treated, over 50 per cent. were followed up, and all remained free from lice for 10–15 days, while 30 per cent. who returned to clean surroundings remained free for over 3 to 6 months. It is emphasised that pyrethrum can safely be applied to the scalp even when extensive ulceration is present.

Of 19 cases of infestation by *Phthirus pubis*, four were children less than 12 years of age, and 15 were adult males. The children were infested on the eyelashes, one also having an adult louse and two nits on the temple. One man was infested on one arm only, another on the chest only, and the rest on the pubic and perineal regions. Shaving of the affected part before treatment was advised in all cases. Infestation of the eye-lashes is now being treated with an ointment of 1 part pyrethrum in 8 parts vaseline [*cf.* **30** 1], which should be applied for five nights in succession, since it does not affect the eggs. Cases of pubic and perineal infestation are sprayed with pyrethrum extract in kerosene applied as for heads, which gives excellent results.

RIBBANDS (C. R.). **The Influence of Rainfall, Tides and periodic Fluctuations on a Population of *Anopheles melas*, Theo.**—*Bull. ent. Res.* **35** pt. 3 pp. 271–295, 8 figs., 19 refs. London, 1944.

The following is the author's summary. Daily catches of adult *Anopheles melas*, Theo. [*cf. R.A.E.*, B **33** 32] were made in occupied huts at Aberdeen, Sierra Leone, from 10th January to 31st October, 1941. These catches are analysed with the following conclusions. The average size of the adult population was closely determined by rainfall, but peak populations did not occur until 20–30 days after the causative rainfall, and there was an initial time-lag of about ten days before any response occurred. The correlation coefficient between rainfall and population size after 24 days (eight-day averages of both) was $0{\cdot}793 \pm 0{\cdot}064$, thus showing a very high degree of association. Increase and decrease in rainfall exerted much greater effects on the size of the population than mere maintenance of the previous level of rainfall. The rate of increase in the population after rainfall was very variable, and the maximum increase was 24·0 per cent. between the averages of successive eight-day periods. There was no evidence that the size of the initial population ever controlled the limits of the increased population, and the maximum rate of increase after rain never approached that recorded after maximum tides in the dry season, when on two occasions the population increased ten-fold in 8–9 days.

There were 29 marked peaks in the size of the *A. melas* population, which occurred at intervals of not more than 16 days. The amplitude of these fluctuations was greatest at the end of the dry season, when peak catches averaged eight times the minimum catches that had occurred only about eight days previously; during the wet season the amplitude was much smaller, and when the population remained fairly constant the average peak size was 45 per cent. above minimum.

In the dry season there were 10 periods of spring tides, and nine of these were followed by an Anopheline peak that occurred 7–9 days after the maximum tide. (On the tenth occasion a peak occurred on the twelfth day: compare this with the much longer time-lag after rainfall.) Apart from these nine mosquito peaks, there were only six other peaks during this season; two of these are

attributed to a heavy storm and so correspond to wet season conditions. This association between maximum tides and *A. melas* peaks is mathematically significant (P=·0015). For the whole dry season, the maximum correlation coefficient between tide and population was 0·243±0·084, after seven days—a small but significant value. For the selected period in the complete absence of rain, the maximum value rose to 0·462±0·084, after nine days. Hence, in the absence of rain, tide exerts a marked effect on the size of the population, but even small quantities of rain greatly reduce the importance of the tidal factor. In the wet season there were nine periods of spring tides, but only three Anopheline peaks after 7–9 days. This relation was not significant, and the correlation coefficient was negative, but mathematically insignificant.

Combining the results from both seasons, and after elimination of the 12 peaks associated with tidal action, analysis showed that 13 out of the 17 remaining peaks occurred after an interval of either 4, 8, 12 or 16 days. (The tidal peaks bore no relation to these intervals.) There is less than one chance in 1,000 that this was a random distribution. Evidence is adduced that these were not due to the emergence of successive filial generations, but to overlapping generations, and the regularity of their occurrence is attributed to the effects of intra-specific competition.

Evidence of periodic fluctuations of wide amplitude in a population of *A. funestus*, Giles, is also provided.

Sinton (J. A.). **Suggestions with Regard to the Prevention of the Spread of Yellow Fever to India by Air Traffic, with special Reference to Insect Transmission.**—*Hlth Bull.* no. 20 (2nd edn.), 40 pp., 20 refs. Delhi, Manager of Publications, 1938. Price 7*d*. [Recd. December 1944.]

This bulletin comprises the unchanged text of the first edition [*R.A.E.*, B **23** 97] together with a summary of a report on the transport and control of *Aëdes aegypti*, L., in aeroplanes [**24** 166].

[Pavlovskiĭ (E. N.).] Павловский (Е. Н.). **Work on Malaria and Parasitology in northern and southern Kirghizia.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 10–19, 4 figs., 1 ref. Frunze, 1940. [Recd. 1945.]

This paper, which introduces those that follow, includes a review of investigations on malaria carried out in the summer of 1935 in the valley of the river Chu (northern Kirghizia), where the disease is of constant occurrence and outbreaks frequently cause suspension of agricultural work at the height of the season. The chief Anopheline breeding places are vast swamps, neglected irrigation ditches and innumerable small streams. As a result, however, of a control campaign begun in 1934, the general incidence of the disease was reduced by 80–95 per cent. in 1935, and there were practically no serious outbreaks. The measures taken comprised oiling, dusting from aircraft, screening houses, the extensive use of mosquito nets, and the treatment of the infected persons.

[Petrishcheva (P. A.).] Петрищева (П. А.). **Culicidae of Kirghizia.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 34–41. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

Notes are given on the local distribution and breeding places of 20 species of mosquitos found in inhabited districts in the north and south of Kirghizia from June to October 1935 [*cf. R.A.E.*, B **23** 113]. The Anophelines that occurred everywhere were *Anopheles maculipennis*, Mg., which was the most common, *A. hyrcanus*, Pall., which was comparatively rare, and *A. claviger*, Mg. (*bifurcatus*, auct.), which is a suspected vector of malaria. *A. maculipennis* was often found in houses, but preferred animal quarters, especially cow-sheds

built of clay or pits about 5 ft. deep in which rabbits were kept. In the south, it was also present at altitudes of 6,500–7,500 ft., the larvae occurring exclusively in water that had seeped through the soil and was often brackish and mineralised. *A. hyrcanus* bred in rice-fields and attacked man only in the absence of cattle. It was found in houses, but only if they were close to breeding places. It occurred at altitudes of up to 3,300 ft. in the north and 6,500 ft. in the south. *A. claviger*, which had a slightly higher altitude range in both areas, attacked man and animals readily in June and August and was particularly active by day. It is likely to transmit malaria in the open as it shelters among vegetation along rivers and lakes where agricultural workers camp.

The Anophelines that occurred only in the south were *A. pulcherrimus*, Theo., *A. superpictus*, Grassi, and *A. maculipennis* var. *sacharovi*, Favr. *A. pulcherrimus* was widely distributed up to an altitude of about 3,800 ft. and is possibly a vector of malaria in many districts. The adults occurred from mid-June to the end of September and were often numerous in dwellings and outhouses ; they were most abundant in August. *A. superpictus* frequently bred in very small streams in flooded areas ; the adults sheltered in houses and animal quarters situated along rivers. *A. m. sacharovi* preferred animals to man.

Conditions are favourable for Anopheline breeding from mid-May to mid-September in the valley of the Chu, which is the most malarious part of northern Kirghizia, and in areas in the south situated at altitudes of 3,600–4,000 ft. The average water temperature during this period is 17–23°C. [62·6–73·4°F.] and development can be completed in 14–25 days. Conditions are equally favourable for five months in some districts in southern Kirghizia, and are everywhere favourable for *A. claviger* from mid-March to the end of October. The summer temperatures of the places in which Anophelines rest indoors in northern Kirghizia are 23–28°C. [73·4–82·4°F.] at which the mosquito cycle of the malaria parasite is completed in 11–14 days. Temperatures above 17°C. [62·6°F.], at which it is completed in 35–40 days, may persist for six months in some shelters, so that fresh infections in houses are possible late in autumn.

[Petrishcheva (P. A.).] **Петрищева (П. А.).** *Anopheles* **of the Chu Valley.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 42–51, 4 figs. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

The breeding places of Anophelines in the malarious valley of the river Chu are swamps, mountain streams, lakes in flooded areas, peat bogs, irrigation ditches, ponds and small swamps formed near neglected wells, reservoirs and pits. *Anopheles maculipennis*, Mg., var. *messeae*, Flni., was the predominant Anopheline in all districts, *A. claviger*, Mg. (*bifurcatus*, auct.) was also widely distributed, and *A. m. typicus*, *A. hyrcanus*, Pall., and *A. hyrcanus* var. *pseudopictus*, Grassi, occurred in small numbers. The overwintered adults of *A. m. messeae* usually abandon their hibernation quarters about the middle of March. They are of no importance in the transmission of malaria, as they are short-lived and seldom occur in inhabited houses, and the spring temperatures in northern Kirghizia are too low to permit rapid development of malaria parasites in mosquitos. The larvae were present from mid-April to September and were found in all types of water except cold springs and shaded areas such as ricefields ; they were particularly abundant in ponds with dense submerged vegetation and in subsoil water that reached the surface in ravines. The adults began to enter hibernation quarters at the end of September. Contact with man was most frequent from mid-June to late September, particularly in July and August, when this Anopheline is responsible for the serious outbreaks of malaria that occur in the valley. Larvae of *A. claviger* were numerous in all types of subsoil waters near dwellings, and in small springs and the shaded zone along the banks of ponds partly fed by springs. The adults were present from mid-March to mid-November, but did not fly far from their breeding places.

They usually sheltered during the day in cow-sheds, caves, orchards and dense growths of reeds and readily attacked man in the open.

The mosquitos usually rested by day in animal quarters in which they had fed on cattle, but also fed by night on cattle in the open and then entered houses in numbers if no other suitable day-time resting places were near.

The possibility of the transmission of malaria in late autumn in houses is discussed [see preceding abstract].

[Petrishcheva (P. A.) & Aluimov (–).] **Петрищева (П. А.) и Алымов (–). The Fauna of *Phlebotomus* and the possible Transmitters of Sandfly Fever in Osh.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 52–58. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

The sandflies found in dwellings and outhouses in the town of Osh (south-western Kirghizia) in 1935 comprised *Phlebotomus caucasicus*, Marz., which was the most numerous, *P. papatasii*, Scop., which came next in abundance but was very sporadic in distribution, *P. sumbaricus*, Perfil'ev, which was the dominant species of the *minutus* group, *P. chinensis*, Newst., which was commoner in dwellings than in outhouses, though it is not usually considered to be a domestic species, *P. grekovi*, Khod., and *P. sergenti*, Parrot, which were not numerous, and *P. alexandri*, Sinton, and *P. pirumowi*, Burakova & Mirzayan, which were rare. Sandflies were practically absent in the new part of the town where the houses are light and airy, with open spaces between them. The places in which they were most abundant were dark fowl-houses half sunk into the soil, dwellings overshaded by creepers or trees with dumps of decaying vegetable remains close by, dark caravanserais and animal quarters built of clay, and burrows of *Mus* (*Rattus*) *turkestanicus*, a rat common in Osh in houses, outbuildings, orchards and vegetable gardens. *P. caucasicus* was often numerous in houses in which there were people suffering from sandfly fever and may possibly be a vector, particularly as the distribution of *P. papatasii* in the town did not coincide with that of the disease. Precipitin tests showed that all the species taken fed indifferently on man and domestic animals ; of those taken in houses, 76 per cent. contained human blood, and of those taken in a cow-shed or fowl-house 42 and 52–66 per cent., respectively, contained the blood of cattle and fowls.

The control measures suggested include town sanitation, the destruction of rodents and their burrows, and digging up the soil in vegetable gardens and orchards in spring and then flooding it for several hours to destroy the over-wintered larvae.

[Naumov (K.).] **Наумов (К.). Certain Problems relating to the Application of aviochemical Work under the Conditions of the Chu Valley in the Kirghiz SSR.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 59–75, 1 fig. 1 ref. Frunze, 1940. [Recd. 1945.]

Experiments in 1935–39 on the application from an aeroplane of dusts against Anopheline larvae in the valley of the river Chu showed that a considerable amount of the dust was wasted owing to defects in the apparatus for applying it. Waste of dust was greatest when the aeroplane had to fly low in order to treat a stream or narrow ravine, and it is concluded that treatment from aircraft is uneconomic except for a large expanse of water.

The dusts used included oleoarsenite [a 1 : 4 mixture of calcium arsenite and oleogumbrin (*R.A.E.*, B **25** 68)], but this was not consistently effective. It killed all the larvae in a stream on one occasion and only 75 per cent. on another when applied at the rate of 0·9 lb. per acre, and killed all the larvae in a pond with submerged and rising vegetation when applied at the same rate and only 78 per cent. of those in a pond devoid of vegetation when the rate

was doubled. A survey of other treated waters showed that the presence or absence of rising vegetation did not cause any appreciable difference in the rate of the kill of the larvae. The oleoarsenite did not remain on the surface of the water for more than 30 hours, and Paris green remained as long as this.

[Naumov (K. G.).] **Наумов (К. Г.). Epidemiological Importance of *An. maculipennis messeae* in the Light of Data of the Reaction of Precipitation.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 76–83. Frunze, 1940. [Recd. 1945.]

Large numbers of *Anopheles maculipennis*, Mg., var. *messeae*, Flni., and a few examples of *A. hyrcanus*, Pall., and *A. claviger*, Mg. (*bifurcatus*, auct.), were collected in the valley of the river Chu in inhabited houses, native tents, fowl-houses, and sheds containing cattle or pigs. Most of the houses are built of straw and clay with roofs of reeds, and the windows are tightly covered with fabric during the day, as a protection against the heat of the sun and the entry of flies, and opened at dusk. Mosquitos that enter the houses in the evening and feed on the inhabitants thus find cool dark shelter during the day. Wherever animal quarters were close to dwellings, however, females containing blood were much more numerous in the former. In a village in which pigs were kept in a row of sheds between the communal huts and a pond where Anophelines were breeding, there were many females containing blood in the sheds made of straw and clay, a very few in those made of reeds with wide cracks in the walls, and only two in the huts.

Precipitin tests for the blood of man, pig, cow and horse in females of *A. m. messeae* showed that 86·2 and 60 per cent. of the examples that gave a positive reaction and were taken in inhabited houses and native tents, respectively, had fed on man, despite the extensive cattle-breeding in the valley. Passages in the houses and store-rooms were evidently used as day-time shelters, as 76 and 81·6 per cent., respectively, of the mosquitos taken in them contained the blood of cattle. Of those from the tents, 40 per cent. had fed on cows, which were kept in the open close by. Over 90 per cent. of the mosquitos from sheds housing cows or pigs had fed on whichever animal the shed contained, and 71·9 per cent. of those from a shed housing horses and cows together, had fed on the cows. Most of the mosquitos from fowl-houses gave a negative reaction, and the others had fed on cattle or pigs.

A. claviger evidently preferred animals to man; 44·5 per cent. of the individuals taken in inhabited houses gave a reaction for the blood of animals, chiefly cattle. *A. hyrcanus* was seldom taken in buildings, but was found to have fed on man, cattle and pigs.

[Naumov (K. G.).] **Наумов (К. Г.). Subspecies of *An. maculipennis* of the Chu Valley.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 84–93, 1 fig., 2 graphs, 1 ref. Frunze, 1940. [Recd. 1945.]

The investigations described were carried out in July–October 1937 in a district in northern Kirghizia that is partly situated in the valley of the river Chu and has a continental climate with maximum and minimum temperatures of 39°C. [102·2°F.] and −39°C. [−38·2°F.] and a mean annual temperature of 9·4°C. [48·92°F.].

Collections of Anophelines from day-time shelters showed that they were practically absent from light and airy dwellings and animal quarters. They were most numerous in dark badly ventilated sheds that were close to dwellings and contained cattle or pigs, and were also attracted by rabbits kept in the entrance passage of a house or just outside it. If, however, there was scarcity of animals, the mosquitos congregated in clay huts and similar dwellings.

Examination of the 408 batches of eggs laid by the females collected showed that 398 were *Anopheles maculipennis*, Mg., var. *messeae*, Flni., four were *A. m. typicus*, and six were unidentifiable. The number of eggs in a batch varied from 5 to 380, with averages of 215 in July, 178 in August and 149 in September. The percentage of females that oviposited also decreased from 72·4 in July to 16·7 in September. Only one batch was laid in October at an average monthly temperature of 10·6°C. [51·08°F.]. Some of the batches contained immature eggs that failed to hatch; they represented 11·3, 14·4 and 10·2 per cent. of the eggs deposited in July, August and September. Their occurrence may possibly have been due to the effect of high temperature on the mosquitos, the mean monthly temperature in August being 37·3°C. [99·14°F.] in the open and 26·3°C. [79·34°F.] in the laboratory. Eggs placed on water containing from 0·5 to 3 per cent. salt were neither killed nor deformed [*cf.* **28** 8].

The number of females containing fresh blood began to decrease after 20th August, while those with a developed fat-body became more numerous. The latter constituted practically the entire population of the shelters by the end of September. This early cessation of feeding prevents *A. m. messeae* from being of importance as a vector of malaria in autumn. The females entered hibernation quarters in November. *A. claviger* Mg. (*bifurcatus*, auct.) was scarce in buildings in July and August, but its numbers increased sharply in September. Many of the females taken in houses and cattle sheds near streams had recently fed, which indicated that they may be of importance in the spread of malaria.

[Luppova (E. P.).] **Луппова (Е. П.). Hibernation Quarters of the Mosquitos of southern Kirghizia.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 94 99. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

In November and December 1935 over 15 thousand buildings of various kinds in the town of Osh and neighbouring districts in south-western Kirghizia were examined for hibernating Anophelines. The species found were *Anopheles maculipennis*, Mg., and *A. superpictus*, Grassi, and the prevalence of one or other depended on the type of breeding place in the locality. *A. maculipennis* was by far the more numerous in the vicinity of rice-fields, and *A. superpictus* occurred alone in the mountain districts.

Of all the places in which the mosquitos were found, 45 per cent. were in inhabited houses, chiefly semi-dark huts built of straw and clay, in which the entrance door remains open for most of the day. They seldom occurred in numbers in any one house, however, and were much more abundant in cattle sheds and disused empty buildings. They were also present in latrines, reed sheds, cellars and garrets. Females of *A. maculipennis* were found once in a tree-hole and those of *A. superpictus* in a cave. The mosquitos were most often found in buildings and sheds near their breeding places, including some on steep river banks 65–100 ft. high. They tended to concentrate in deep shade, usually on the ceiling or a hanging cobweb, and less frequently on the walls. They flew readily when disturbed in the first ten days of November, but became inactive as the temperature fell, most of them hiding deep in the wattle ceilings. Females with a developed fat-body occurred from the beginning of November, but single freshly fed ones were taken up to 20th November.

[Luppova (E. P.).] **Луппова (Е. П.). Contribution to the Biology of Mosquitos of the Family Culicidae in some Regions in the Chu Valley.** [*In Russian.*]—*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 100–106, 2 figs. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

Notes are given on the local distribution, seasonal occurrence and abundance of 14 species of mosquitos observed from the end of June to the end of October in the lower valley of the river Chu and in a district near the town of Frunze,

northern Kirghizia. *Anopheles maculipennis*, Mg., var. *messeae*, Flni., was one of the commonest species and was particularly abundant near ponds; it constituted 90 per cent. of all the mosquitos taken by day in buildings in which they had fed at night. The other Anophelines found were *A. hyrcanus*, Pall., and *A. h. mesopotamiae*, Chr. & K. C., which occurred only in the flooded area of the river Chu and very occasionally entered houses in the evening to feed, and *A. claviger*, Mg. (*bifurcatus*, auct.), which was taken among vegetation and in inhabited houses and animal quarters, and bred in swamps formed by cold subsoil water.

[Petrishcheva (P. A.) & Polyakov (A. Ya.).] **Петрищева (П. А.) и Поляков (А. Я.). Malaria in the Naruin Coal Mine in southern Kirghizia.** [*In Russian.*] —*Sovetsk. Zdravookhran. Kirgizii* **3** no. 5 pp. 110–116. Frunze, 1940. (With a Summary in Kirghiz.) [Recd. 1945.]

The Naruin coal mines are in an area in southern Kirghizia that was uninhabited until the introduction of large numbers of mine workers, chiefly from European Russia. In 1932, as soon as the mining settlement had been established, *Anopheles superpictus*, Grassi, appeared in numbers and malaria became a serious problem [*cf. R.A.E.*, B **20** 117], with malignant tertian [*Plasmodium falciparum*] as the predominant type. *A. superpictus* constituted 97·6 per cent. of all the Anophelines found there in August 1935, the others being *A. claviger*, Mg. (*bifurcatus*, auct.), *A. pulcherrimus*, Theo., and *A. maculipennis*, Mg., var. *sacharovi*, Favr.

Favourable breeding places for the mosquitos are provided by innumerable minute streams almost hidden by dense filamentous algae, sunlit water along the pebbly banks of springs and mountain streams and in depressions in the sandy shoals of the river Naruin, flooded meadows, an irrigation ditch, and small pools near a pump. Larvae of *A. superpictus* occurred even in a very polluted narrow stream originating in a mine gallery and containing a considerable amount of floating coal dust [*cf.* **23** 73]. The adults were not common in dwellings; over 50 per cent. of all the Anophelines collected were taken in outhouses, and about 20 per cent. were found elsewhere, chiefly in disused huts some five miles from the mines.

The total area over which control of the larvae was required was not extensive, but the breeding places in it were numerous, small and difficult to find, as they were hidden among stones and vegetation. In 1935 and 1936 the area was inspected at intervals of 8–10 days, and all the breeding places found were filled with soil, sand or pebbles. Streams were straightened and the inlets in them oiled if too large to fill up. As a result, the incidence of malaria and particularly malignant tertian, decreased sharply, so that the mines could be considered almost free from the disease.

Unti (O.). **Hidroquímica dos criadouros de *Anopheles* do Estado de S. Paulo.** [Hydrochemistry of the Breeding Places of *Anopheles* in the State of São Paulo.]—*Folia clin. biol.* **15** fasc. 1 pp. 1–12, 4 refs. São Paulo, 1943.

The author summarises and discusses the results of some 900 chemical analyses in 1939–42 of water from the principal breeding places of Anophelines in the State of São Paulo, Brazil, over 600 of which were made in the Paraiba Valley, and reviews the geological formations and species of *Anopheles* found in the various regions concerned. Some of the results have already been noticed [*R.A.E.*, B **33** 20]. It is concluded that the absence of malaria in the Paraiba Valley is not due to the chemical constitution of the water in Anopheline breeding places there, since this did not differ significantly from that in malarious regions. Almost all the species of *Anopheles* present in the regions considered, whether vectors of malaria or not, bred in water showing the same ranges of

chemical properties and constituents and occurred indifferently in water that did and did not contain dissolved nitrogen, nitrites, bicarbonates and sulphates. Breeding was not affected by the presence of ammoniacal nitrogen and occurred in water ranging in pH from 6·2 to 7·5. All the waters tested were rich in dissolved iron [*cf. loc. cit.*].

Corrêa (R. R.). **Da infeção natural, pela plasmodiose malárica, do** *Anopheles* (*Kerteszia*) *cruzi* **D.-K., 1908.** [Natural Infection of *A. cruzi* by the Malaria *Plasmodium*.]—*Folia clin. biol.* **15** fasc. 1 pp. 23–32, 11 figs., 11 refs. São Paulo, 1943. (With a Summary in English.)

The only Anophelines found in 1942 on a section of the new road from São Paulo to Santos that passes through the mountainous forest region known as Serra do Mar, at altitudes of some 650–1,600 ft., were *Anopheles eiseni*, Coq., and *A. cruzi*, D. & K. [*cf. R.A.E.*, B **33** 21]. Larvae of the former were observed in pools of rain water; but no adults were taken attacking man, either by day or by night, in houses or in the forest, so that it is probably of no importance in the transmission of malaria. Larvae of *A. cruzi* occur in water in the leaves of arboricolous bromeliads, and were found, at heights greater than 16 ft., in 19 of 310 plants examined. The pH of the water was 5·0–5·2. Numerous females were taken attacking man in the forest, and 125 about 50 yards from a group of houses containing gametocyte carriers. Of these, 75 were dissected; three contained oöcysts of *Plasmodium* on the stomach and one also sporozoites in the salivary glands. *A. cruzi* is therefore a vector of some importance in the region.

Coda (D.). **Dados epidemiológicos referentes à malária na vertente atlântica (contribuição ao saneamento da Baixada Paulista).** [Epidemiological Data on Malaria on the Atlantic Slope (Contribution to Public Health Work in the São Paulo Lowlands).]—*Folia clin. biol.* **15** fasc. 1 pp. 53–63. São Paulo, 1943.

The author divides the coastal region of the State of São Paulo [*cf. R.A.E.*, B **30** 19, 21] into four geographical areas, surveys the rivers in each, and gives figures for the years 1932–41 showing the incidence of malaria in 16 selected municipalities, and lists of the species of *Anopheles* that have been taken in nearly 30 localities.

Corrêa (R. R.). **Do ciclo evolutivo em condições experimentais do** *Anopheles* (*Kerteszia*) *cruzi*, **Dyar and Knab, 1908.** [The developmental Cycle of *A. cruzi* under experimental Conditions.]—*Folia clin. biol.* **15** fasc. 1 pp. 64–68, 4 figs., 4 refs. São Paulo, 1943. (With a Summary in English.)

Females of *Anopheles cruzi*, D. & K., taken at Guaruja, São Paulo, were kept in tubes containing damp cotton-wool and filter paper, on which they oviposited. The eggs were placed in small dishes of tap water with a pH of 7·1–7·3, and, two days after hatching, the larvae were transferred to larger dishes, curds of milk being provided as food. The water was changed as soon as a film formed on the surface, and the temperature ranged from 20 to 30°C. [68–86°F.]. The egg, larval and pupal stages occupied 3, 15 and 2 days, respectively. Brief notes are given on the morphology of the larva and the genitalia of the males.

[DE] BEAUREPAIRE ARAGÃO (H.). **O virus do mixoma no coelho do mato** (*Sylvilagus minensis*), **sua transmissão pelos** *Aëdes scapularis* **e** *aegypti*. [The Virus of Myxomatosis in the Wild Rabbit (*S. minensis*), and its Transmission by *A. scapularis* and *A. aegypti*.]—*Mem. Inst. Osw. Cruz* **38** fasc. 1 pp. 93–99, 3 figs., 3 refs. Rio de Janeiro, 1943. (With a Summary in English.)

Outbreaks of myxomatosis occur in domestic rabbits in Brazil, causing considerable mortality, although no new stock may have been introduced into rabbit farms for long periods previously. In investigations on the disease, one wild rabbit (*Sylvilagus minensis*) from the State of Rio de Janeiro was found to be naturally infected, and two bred in the laboratory both acquired the disease when infected artificially. Tests with 42 wild rabbits obtained commercially from the Federal District and the States of Rio de Janeiro, Minas Geraes and São Paulo showed that only about 40 per cent. of these acquired the disease. It took a milder form than in domestic rabbits and was seldom fatal. It is concluded therefore that wild rabbits constitute a natural reservoir of the virus and that they can acquire immunity from it.

Fleas and *Culex fatigans*, Wied., had previously been shown to transmit myxomatosis of rabbits in Brazil. In experiments with *Aëdes aegypti*, L., and *A. scapularis*, Rond., females that had fed on tumours or tissue adjacent to them on wild rabbits transmitted the virus to healthy rabbits for up to 17 days after the infecting feed. The tests with *A. scapularis* were carried out by taking mosquitos that came to feed on an infected wild rabbit exposed in a wood to the laboratory and allowing them to feed on healthy rabbits. They transmitted the virus two or three times at intervals of a few days to domestic and wild rabbits, tumours appearing after 5–7 days at the site of the feed.

The virus did not multiply in the mosquitos and was present only in the proboscis 6–17 days after the infecting feed, suspensions of the thorax and abdomen proving non-infective when injected into rabbits. Transmission is therefore mechanical. Outbreaks among domestic rabbits in Rio de Janeiro are commonest in summer, from December to March, when mosquitos, especially *C. fatigans* and *A. scapularis*, are most abundant.

PRITCHARD (A. E.) & PRATT (H. D.). **I. A Comparison of Light Trap and Animal Bait Trap Anopheline Mosquito Collections in Puerto Rico. II. A List of the Mosquitoes of Puerto Rico.**—*Publ. Hlth Rep.* **59** no. 7 pp. 221–233, 2 pls., 5 graphs, 6 refs. Washington, D.C., 1944.

The following is mainly based on the authors' summary of the first section of this paper. A trap containing a horse or calf as bait [*cf. R.A.E.*, B **23** 302] has been used with considerable success in Porto Rico for 17 years for sampling populations of adult female Anophelines. In comparative tests in 1942–43, however, *Anopheles albimanus*, Wied., the principal vector of malaria on the Island, was attracted in considerable numbers to New Jersey suction light-traps with 40–60 watt bulbs [*cf.* **32** 228], which proved superior to the bait-trap for this species. *A. grabhami*, Theo., was sometimes attracted in large numbers to the light-trap, but comparative collections indicated that it was generally caught in larger numbers by the bait-trap, though the two types appeared to give similar indices of abundance when populations were low. Although it has been supposed that *A. grabhami* is not attracted by man in Porto Rico [*cf.* **16** 209], 127 females were taken from a bait trap after a man had slept in it for a night. Females of *A. vestitipennis*, D. & K., seemed to be more readily taken in a light-trap than a bait-trap when there was only a sparse population, but less readily when populations were larger. Males of the three species were taken in the light-traps. It is concluded that the light-trap is the better for

evaluating Anopheline densities, because it collects both sexes and is more easily operated, the attraction may be standardised, and catches may be collected at any time. However, as this requires a source of electricity, the bait-trap must continue to be the more generally employed in Porto Rico. The combined use of both traps will give a better estimate of population than either alone.

The second section contains a list of the 29 species of mosquitos known to occur in Porto Rico, and shows for most of them the places where they were found in light-trap collections. Many of the species were taken in bait-traps also. Six species recorded from Porto Rico by Tulloch, including *Anopheles crucians*, Wied. [**26** 38], are omitted from the list, as the authors consider that they were probably misidentifications.

COVELL (G.). **The Prophylaxis and Treatment of Malaria in War.**—*J. Malar. Inst. India* **5** no. 2 pp. 129-157, 11 graphs, 95 refs. Calcutta, 1943.

Active-service conditions have a considerable influence on the conduct of anti-malaria work, particularly that branch of it dealing with the Anopheline vectors. Some of the factors involved are the movement of troops by day and night, the employment of large numbers of men on night duty, the difficulty of enforcing measures of personal protection, the aggregation of labourers with the consequent introduction of new strains of malaria parasites among the troops, the placing of camps near malarious villages for strategic reasons, the dispersion of troops over wide areas, difficulties of transport and shortage of anti-malarial equipment, larvicides, insecticides for sprays, repellents, drugs and labour. With these in mind, relevant information on the use of anti-malarial drugs is summarised, and anti-mosquito measures adapted for field-service conditions are discussed. They are the selection of sites at least half a mile away from local habitations wherever possible and away from breeding places; spray-killing of adult Anophelines [*R.A.E.*, B **26** 180; **31** 117; **32** 150, etc.] in camps and in all local dwellings, recently deserted villages and other likely resting places within half a mile of them, this being the only immediately effective means of arresting a malaria epidemic already in progress; the use of mosquito nets by men who sleep at night; the postponement of early morning parades until at least an hour after dawn; the use of repellents, particularly pyrethrum extract or dimethyl phthalate, and of suitable clothing; control of Anopheline larvae by such methods as the removal of vegetation from the edges of breeding places, canalisation of streams, flushing of streams and drains and pollution of breeding places; improvised methods of subsoil drainage with stones, sticks, bamboos, corrugated sheeting or disused cans; the application of Paris green to breeding places by spraying methods to economise transport [**27** 232; **29** 112, etc.], and the use of waste engine oil as a larvicide alone or if possible in combination with other oils.

SENIOR WHITE (R.), ADHIKARI (A. K.), RAMAKRISHNA (V.) & ROY (B. B.). **On Malaria Transmission on the Orissa Coastal Plain.**—*J. Malar. Inst. India* **5** no. 2 pp. 159–186, 14 refs. Calcutta, 1943.

The Orissa coastal plain is a strip of alluvial land, in no place more than 100 miles wide, extending northwards from Puri for more than 170 miles. It is crossed by several rivers and subject to serious floods. A list is given of the 17 species of *Anopheles* found by the authors in the plain, and one other recorded by an earlier worker, with brief notes on their prevalence. *A. annularis*, Wulp, is the most abundant. It formed 70 per cent. of all the collections made for dissection, which were from eight localities and mainly from houses. In the course of 12,987 dissections of females of 13 species made over a number of

years, gut infections were found in one female each of *A. culicifacies*, Giles, *A. ramsayi*, Covell, and *A. pallidus*, Theo., three of *A. aconitus*, Dön., and 14 of *A. annularis*, and gland infections in two females of *A. aconitus* and seven of *A. annularis*. The isolated gut infections are considered of no epidemiological significance. It is concluded that although its oöcyst and sporozoite rates were only 0·15 and 0·08 per cent., respectively, *A. annularis* is the principal vector on account of its preponderance. The oöcyst and sporozoite rates of *A. aconitus* were 0·3 and 0·2 per cent., and it was the only species found infective in some places ; although it is only one-tenth as abundant as *A. annularis*, its importance appears to be more than secondary. All the positive results were obtained between September and December. A very large population of *A. annularis* was built up at this time, as the output of the breeding places was greatest and adult life was prolonged in autumn. This increased the chances of an individual feeding twice on man and made effective transmission possible, although females were more often found in cow-sheds than houses.

The principal breeding places of *A. annularis* proved to be rice-fields, reservoirs and borrow-pits. Larvae were occasionally found in slowly moving water, but still water with floating vegetation and filamentous algae was favoured. *A. aconitus* bred in similar places, but did not appear to have so marked a preference for completely still water. Larvae were found in rice-fields in November and December only and in reservoirs from November to April. Adults were most abundant from January to March, but no infective females were found at that time.

Malaria epidemics in Orissa are superimposed on a considerable amount of endemicity. They are very local and apparently depend upon biological factors favouring the production of *A. annularis* in the neighbourhood. The application of larvicides to overgrown reservoirs and borrow-pits is not a practicable control measure, and the obvious solution is clean weeding. The effect and cost of this in three reservoirs are discussed ; the numbers of larvae of *A. annularis* were reduced by 41 per cent. in the first season and 56 per cent. in the second, but it was not possible to assess how much control would result if no other measure were being employed. Breeding among filamentous algae in the rice-fields is dealt with by applying 2 per cent. copper sulphate powder in the same way as Paris green, about September and again later if required, to destroy the algae.

Senior White (R.) & Venkat Rao (V.). **On Malaria Transmission around Vizagapatam.**—*J. Malar. Inst. India* **5** no. 2 pp. 187–205, 18 refs. Calcutta, 1943.

Along nearly the whole of the Indian coast of the Bay of Bengal, the mountains are separated from the sea by a plain where very little malaria occurs, but for some 14 miles around Vizagapatam, the hills of the Eastern Ghats extend to the sea and malaria transmission is considerable. The literature on malaria surveys and control work in this small region is reviewed. As a result of the early work, it was thought that *Anopheles culicifacies*, Giles, was the vector although gland infections were not found. Control measures in two important railway areas were at one time directed against this species as well as *A. stephensi*, List., and the *funestus* group (*A. fluviatilis*, James, *A. minimus*, Theo., and *A. varuna*, Iyen.) but from 1938 onwards, *A. culicifacies* was disregarded in control programmes in view of the results of local dissections [*cf. R.A.E.*, B **29** 72]. No increase in malaria occurred as a result. In 1940, the junior author reached the opinion that *A. varuna* was of no importance locally, as nine months' collecting had shown it to be rare in houses. An intensive investigation was therefore begun. Preliminary results have already been noticed [**30** 103], and these are incorporated in the present paper.

A list is given of the 22 species of *Anopheles* that have been found in the locality. Of the eight that are known vectors of malaria in east central India,

four were extremely rare, and *A. annularis*, Wulp, formed only 4·4 per cent. of larval catches and bred chiefly in reservoirs, which are not common, and borrow-pits, which do not support the heavy flora that is found further north. This left only *A. varuna*, *A. culicifacies* and *A. stephensi* to be considered. They constituted 5, 41·7 and 0·4 per cent., respectively, of over 30,000 larvae taken during routine searching for 36 months in 1938–41 in all types of water in the two controlled railway areas, where the figures might have been affected by the different reactions of individual species to oiling, and 49·8, 33·8 and 1 per cent. of nearly 10,000 larvae collected throughout one season in water courses and wells in seven uncontrolled localities. Water courses were the preferred breeding places of *A. stephensi* and *A. culicifacies*. Rice-fields are unimportant, as the only potential vector occurring in them was *A. culicifacies*, and they accounted for only 2·7 per cent. of the larvae of that species found. Adult catches made in houses and cattle-sheds in eight villages for varying periods showed that females of *A. culicifacies* rested almost as frequently in houses as in cattle-sheds and those of *A. stephensi* three times as often, but cattle-sheds contained over ten times as many of *A. varuna* as houses. The figures included those from one village where the cattle-sheds contained only 16·3 per cent. of *A. culicifacies* but 63·5 per cent. of *A. varuna*.

Two identical huts of the cattle-shed type attractive to *A. varuna* [**30** 103], with the thatch brought down to the ground level, were constructed in one railway area where this species was plentiful, and human bait was used in one and buffalo in the other. The entrances had a sacking cover, raised at night and lowered at dawn. Catches of more than 11,000 females made over more than a year in 1940–41 confirmed the preference of *A. varuna* for bovine blood. It was 9·6 times as frequent in the presence of buffalo as in that of man, and formed 73·4 per cent. of the catch in the hut with the buffalo and only 42·7 per cent. of the catch in the other hut. Comparatively small numbers of *A. culicifacies* were taken. It was 4·8 times as prevalent in the presence of buffalo as in that of man. *A. stephensi* was virtually absent. Gland infections were found in two females of *A. varuna*, one from each hut, and a double infection was found in a female of *A. culicifacies* from the hut with human bait. These were the only gland infections found in these two species, and combining the results for the whole Vizagapatam region, they gave sporozoite rates for *A. culicifacies* and *A. varuna* of only 0·015 and 0·017 per cent., respectively. Precipitin tests with material from this area showed that both species fed much more often on cattle than on man. It is concluded from a discussion of the data that neither is a vector locally. There was no significant difference between the maxillary indices of *A. culicifacies* taken at human and buffalo bait, nor between those of *A. varuna* from the coast and the hills.

In November 1940, an outbreak of malaria occurred in a village about nine miles north of the railway area where most of the investigations had been carried out, and regular catches were made in houses and cow-sheds in this village and neighbouring ones. The 5,532 females of *A. culicifacies* and 128 of *A. varuna* taken were all negative, but oöcyst and sporozoite rates of 2·7 and 1·8 per cent., respectively, were found in 225 females of *A. stephensi*. All the eggs of this species examined were of the race *mysorensis*, Sweet & Rao, and it is concluded that this form is the principal vector in the rural areas around Vizagapatam. It gives rise to localised epidemics in seasons in which malaria is prevalent. It was found infected in August, October, November, January and February.

Senior White (R.). **On Malaria Transmission in the Hazaribagh Ranges, including Ranchi Plateau.**—*J. Malar. Inst. India* **5** no. 2 pp. 207–231, 1 map, 1 graph, 9 refs. Calcutta, 1943.

The tract of hill country with which this paper deals is defined, and the literature on malaria there is reviewed. Accounts are given of the nature of the

various places in which Anophelines were collected over a period of years beginning in 1936, together with data on the spleen indices in them in practically all cases. The area is not epidemiologically homogeneous. There is hyperendemicity at the west and south and epidemicity superimposed on endemicity at the eastern end. Conditions in the centre of the ranges are unknown. A list is given of the 21 species of *Anopheles* that have been recorded in the area, and the results of the 17,534 dissections made with 16 species are tabulated. Apart from the finding of oöcysts once in *A. annularis*, Wulp (0·1 per cent.) and twice in *A. pallidus*, Theo. (0·05 per cent.), the only species with which positive results were obtained were *A. fluviatilis*, James, *A. culicifacies*, Giles, and *A. varuna*, Iyen., of which 2,167, 9,571 and 131, respectively, were dissected and 2·1, 0·2 and 2·3 per cent. had gut infections and 1·4, 0·02 and 1·5 per cent. gland infections. It is concluded that *A. fluviatilis* is the principal vector of malaria and transmits it from September to March. Precipitin tests with females of this species taken by Said in the east of the area showed that nine of 24 from dwellings and two of 16 from cow-sheds contained human blood. *A. culicifacies* transmits to some extent in July and August and possibly September, when it is most abundant. *A. varuna*, which formed only 6 per cent. of the adults of the *fluviatilis-varuna* group, is considered too rare to play any considerable part in transmission. It was the only species found infective in one area, but the results were vitiated by control measures and the author believes that the principal vector there is *A. fluviatilis*, although dissection failed to show it. *A. minimus*, Theo., was very rare, forming only 0·2 per cent. of the *funestus* group (*minimus*, *fluviatilis* and *varuna*). The results obtained by Roy & Biswas [*R.A.E.*, B **31** 118] in Dharamjaigarh, which falls within this area, are discussed. Their finding of a sporozoite rate of 0·7 per cent. in *A. pallidus*, is stated to be contrary to all previous results with this species in the area.

The town of Jharsuguda, some miles from the southern face of the hills on a black cotton soil plain, seems to be an entirely separate problem, an outbreak of malaria that occurred in 1940 having apparently been caused by an increase in both races of *A. stephensi*, List. [*stephensi* and *mysorensis*, Sweet & Rao], accompanied by *A. varuna*, in the wells of the town, of which there are more than 500. The stocking of these wells with *Gambusia* may prevent a further outbreak.

DE BURCA (B.). **A new Species of *Anopheles* from East Africa.**—*J. Malar. Inst. India* **5** no. 2 pp. 233–234, 1 ref. Calcutta, 1943.

Descriptions are given of the larva and reared adult male of *Anopheles* (*Myzomyia*) *amutis*, sp. n., one larva and two larval pelts of which were found in September 1942 in a large pool with gently flowing water in the bed of a hill stream in central Eritrea at an altitude of 7,200 ft. The climate in this locality is too cold for the breeding of Anophelines other than *A. cinereus*, Theo., and *A. squamosus*, Theo., except in August and September, but larvae of several species, including *A. gambiae*, Giles, and *A. funestus*, Giles, were found in the same stream in September.

DE BURCA (B.) & IMDAD ALI SHAH. **The Anopheline Mosquitoes of Eritrea and their Relation to Malaria Transmission.**—*J. Malar. Inst. India* **5** no. 2 pp. 235–245, 3 pls., 1 map, 14 refs. Calcutta, 1943.

Lists are given of the species of *Anopheles* previously recorded from Eritrea and of the 18 species now known to occur there. The numbers of adults and larvae of both sexes of various species identified in western Eritrea in 1941 and at various altitudes in eastern and central Eritrea in the first three quarters of 1942 and in October of that year are shown in tables. Notes are given on each species, regarding such points as prevalence, breeding places, adult

resting places, seasonal and local distribution and relation to malaria. Most of the notes are based mainly on observations made in malarious localities. Transmission occurs at altitudes of up to some 6,600 ft., and epidemic conditions were observed at 6,300 ft. in one locality. The only species found infected was *A. gambiae*, Giles, in which 27 gut and 10 gland infections were found in 35 females out of 1,818 dissected, some from controlled and some from uncontrolled areas. It is the commonest and most widespread Anopheline in the area, and was reported from sea level to over 8,000 ft. Adults were rarely found except in dwellings. The typical breeding places were small sandy pools exposed to direct sunlight, but larvae could be found in any water either indoors or out. Seasonal prevalence varied from one area to another. *A. funestus*, Giles, was found at 7,200 ft., probably the greatest altitude at which it has been recorded, but it was not seen at any altitude at which malaria might be transmitted. It is thought probable that *A. gambiae* is the only local vector of importance, but southern Eritrea was not visited and nothing is known regarding the part that *A. dancalicus*, Corradetti, and *A. culicifacies* var. *adenensis*, Christ., may play there.

RAJINDAR PAL. **On the Histological Structure of the Midgut of Mosquitoes.**—*J. Malar. Inst. India* **5** no. 2 pp. 247–250, 1 pl., 5 refs. Calcutta, 1943.

The following is based on the author's summary and conclusions. A careful study of the histological structure of the midgut of females of *Anopheles culicifacies*, Giles, *A. stephensi*, List., *A. subpictus*, Grassi, and *Culex fatigans*, Wied., failed to reveal any marked differences between the species. The detailed structure appeared to be the same as that described for *Anopheles maculipennis*, Mg., by Grassi and Christophers in 1901 and by Nuttall & Shipley in 1903, with the exception of the peritrophic membrane. This membrane, which according to some workers is absent in adult mosquitos, was found in all the species examined [*cf. R.A.E.*, B **31** 54]. There was no evidence that the development of malaria parasites in the mosquito is influenced by differences in the histological structure of the midgut.

RAJINDAR PAL. **On the Longevity of *Anopheles fluviatilis* James under controlled Conditions of Temperature and Humidity.**—*J. Malar. Inst. India* **5** no. 2 pp. 251–253, 1 graph, 2 refs. Calcutta, 1943.

The following is mainly based on the author's summary of the results of observations on the length of life of females of *Anopheles fluviatilis*, James, under controlled conditions of temperature and humidity. The mosquitos were the offspring of females collected from a cattle-shed at Lahore and were given a blood meal about 10 hours after emergence. They did not live for more than 18 hours at 104°F., and variations in relative humidity had no effect at this temperature. They survived for 10 days at 95°F. and 100 per cent. relative humidity, 17–18 days at 85°F. and 60–80 per cent., 50 days at 65°F. and 59–63 days at 55°F. Temperatures from 68 to 85°F. and a relative humidity between 50 and 80 per cent. were optimum conditions for prolonged survival.

VISWANATHAN (D. K.) & RAMACHANDRA RAO (T.). **The Behaviour of *Anopheles fluviatilis* James as regards the Time of Entry into Houses and of Feeding.**—*J. Malar. Inst. India* **5** no. 2 pp. 255–260, 3 refs. Calcutta, 1943.

An account is given of preliminary studies made near Sirsi in North Kanara District, Bombay Presidency, on the time at which females of *Anopheles fluviatilis*, James, the principal malaria vector in the district, enter dwellings and feed. Observations were made every night between 28th May and 9th

June 1943 in a tent set up within 100 feet of a group of three habitations and a cattle-shed with no other occupied dwellings within about half a mile. An irrigation channel passed near the dwellings and a perennial stream ran parallel to it about 500 feet away. Larvae had been found in fair numbers early in May, but owing to heavy rains during the middle of the month, breeding had become very slight in the perennial stream, and the output of adults was small. Two or three persons passed each night in the tent, protected by mosquito nets, and one entrance of the tent was kept open. The tent was cleared of mosquitos at 8 p.m. (new Indian Standard Time), and they were then collected hourly till 7 a.m. Darkness set in at about 8·30 p.m. and daylight began at 6·30 a.m. Humidity was high. The 30 adults of *A. fluviatilis* that entered the tent, all did so before midnight, except for two males and one female collected at 7 a.m. All the 27 females that entered early, 22 of which were collected at 9 or 10 p.m., had empty abdomens with neither visible blood nor developed ova and were presumably seeking an opportunity to feed, while the single one collected at 7 a.m. had a slight trace of fresh blood in it and was evidently seeking shelter. The other mosquitos collected were taken at 9 or 10 p.m., or at 7 a.m. Those taken at 9 or 10 p.m. were one female of *A. culicifacies*, Giles, and one of *A. karwari*, James, both containing blood, and two females of *A. karwari*, one of *A. jamesi*, Theo., and two of *A. jeyporiensis*, James, unfed and without ovarian development. Relatively large numbers of *A. vagus*, Dön., of both sexes were collected at 7 a.m., all certainly seeking shelter. One male of *A. culicifacies* and two males and one female of *A. jeyporiensis*, were also taken at 7 a.m. Of the 27 females of *A. fluviatilis* dissected, 12 were infected with *Plasmodium*, 10 with sporozoites and 8 with oöcysts. All those of which the spermathecae were examined had mated. All had stage II ovaries [*R.A.E.*, B **29** 93], except one that had absolutely fresh wings [*cf. loc. cit.*] and the ovary in stage I, although it had mated.

The conditions of the abdomens of females of *A. fluviatilis* taken during periodical collections made on five nights in late June in an isolated occupied house known to shelter large numbers are shown in a table. The occupants of the house did not use mosquito nets. Of the 19, 20, 5 and 16 females of *A. fluviatilis* collected at 10 p.m., 1 a.m., 4 a.m. and 7 a.m., respectively, 1, 14, 5 and 13 contained fresh blood, indicating that some females feed very early, a large proportion are fully fed before midnight and some feed in the latter part of the night. Females of six other species were collected. Only *A. jeyporiensis* was moderately abundant, and its behaviour as regards time of feeding appeared to be very similar to that of *A. fluviatilis*. The presence of a vector that not only enters houses soon after dark but may also begin to feed immediately calls for the careful application of methods of personal protection, as the danger of becoming infected before retiring to bed is great. This may account for the fact that *A. fluviatilis* is such an effective vector. The number of adults collected in houses during the day in North Kanara is extremely high in relation to the intensity of breeding, and this suggests that this species probably does not rest out of doors to any great extent in this district.

WHITEHEAD (F. E.). **The Effect of various Diluents on the Toxicity of Derris Dust to House Flies** (*Musca domestica* **L.**).—*Proc. Okla. Acad. Sci.* **24** pp. 27–28. Guthrie, Okla., 1944.

Experiments in which the test insect was *Musca domestica*, L., were carried out to determine whether the insecticidal action of derris dust could be increased by using a diluent other than talc, which is the one commonly employed. Three parts by weight of the diluents were thoroughly mixed with 1 part derris (5 per cent. rotenone), and the flies were exposed for 30 seconds to a current of air carrying a weighed amount of the mixture and then transferred to an undusted cage. The diluents and (in brackets) the percentage mortality

when each was used were : precipitated sulphur (93·5), cupric sulphide (90·9), dusting sulphur (89·5), powdered sodium chloride (85·4), barium carbonate (71·0), tannic acid (69·8), zinc oxide (69·4), talc (41·0), acetanilide (40·3), paraformaldehyde (33·3), calcium carbonate (22·8), zinc carbonate (17·6), calcium hydroxide (15·6), magnesium oxide (14·9), kaolin (11·6) and manganese dioxide (11·5). It is pointed out that these mixtures might not show the same differences in a relative toxicity to insects of other species, and that some of the diluents would not be safe to use on plants ; sulphur scorches cantaloupe melons severely. The tests strongly indicate, however, that a diluent for derris more effective than talc may be found for use against insects commonly controlled by derris dust.

MILLER (A. W.). **Report of the Chief of the Bureau of Animal Industry, Agricultural Research Administration, 19**[42–]**43.**—48 pp. Washington, D.C., U.S. Dep. Agric., 1944.

This report includes an account of the progress made during the year ended 30th June 1943 in the campaign for the eradication of *Boophilus annulatus*, Say, from cattle and other animals in the United States [*cf. R.A.E.*, B **31** 230]. Ten counties in Florida and Texas remained under quarantine at the end of the period, the only change made being the release of an area of 42 square miles in Florida. All deer examined from the Big Cypress Swamp in Florida were found to be free of infestation, and it is believed that the reduction of their numbers brought about by hunting and removal of deer over a period of four years has cleared the region of the tick. Ticks were brought into the lower Rio Grande Valley of Texas from Mexico on several occasions, and it is thought that the construction of a drift fence is the most practical method of controlling irregular movements of livestock across the border. Constant patrolling has apparently prevented the tick from spreading into the parts of Texas that have been released from quarantine. In Porto Rico, where the tropical variety, *B. a. microplus*, Can. (*australis*, Fuller), is prevalent, work was discontinued from October 1942 to May 1943, and some reinfestation occurred as a result.

Outbreaks of anaplasmosis of cattle were found to show a close connection with the prevalence of Tabanids and no connection with the prevalence of ticks or mosquitos.

The effectiveness against cattle grubs [*Hypoderma*] of dipping cattle in a suspension of cubé (containing 5 per cent. rotenone) at the rate of 1·6 oz. cubé per 1 U.S. gal. water [*loc. cit.*] was confirmed in large-scale experiments. As in previous years, more consistently good results were obtained in Colorado and New Mexico, where the grub season is relatively short, than in Texas, where it is longer. Work against the sheep " tick " [*Melophagus ovinus*, L.] is briefly reviewed [**32** 65].

THEILER (G.). **Notes on the Ticks off domestic Stock from Portuguese East Africa.**—11 × 9 ins., 55 pp., 14 pls., 36 refs. Lourenço Marques, Estaç. antimalár., 1943.

Descriptions are given of the adults, and, in some cases, nymphs and larvae of 13 out of 14 species of ticks recorded on domestic animals in Portuguese East Africa and of one species that occurs in neighbouring countries, with notes on their hosts, biology and relation to disease and usually on their distribution. *Hyalomma impressum*, Koch, is represented by two varieties, *transiens*, Schulze, and *rufipes*, Schulze, which are described in some detail ; both are found on cattle. The other species include *Boophilus fallax*, Minning, which was described in a paper already noticed [*R.A.E.*, B **22** 253] and is the species recorded in South African literature as *B. annulatus*, Say, or *B. a. microplus*, Can. (*australis*, Fuller). A key to the genera of Ixodids found in Portuguese East

Africa is also included, as well as a discussion of the varieties of *Haemaphysalis leachi*, Aud. A survey in the Union of South Africa indicates that at least three varieties of this species are present. The typical one is found on domestic dogs throughout the Union and may occasionally attack other domestic animals. A second, provisionally identified as var. *indica*, Warb., is the typical parasite of most of the South and East African Carnivora, especially the small ones, and it has once been recorded on a domestic cat in Uganda. The third, briefly described as var. *humerosoides*, n., has been taken on dogs in Portuguese East Africa and on *Felis ocreata ugandae* and *Euxerus erythropus lacustris* in Uganda. Comments are made on some previous records of ticks from Portuguese East Africa and neighbouring territory.

Bostock (F.) & Denyer (R. C.). **Lice and Mange of Pigs. Insidious Diseases that cause considerable Loss.**—*Agric. Gaz. N.S.W.* **55** pt. 2 pp. 70–74, 3 figs., 1 ref. Sydney, 1944.

Lice [*Haematopinus*] and mange mites (*Sarcoptes suis*, Gerl.) are the most important skin parasites of pigs in New South Wales. The female louse oviposits daily for about three weeks, laying a total of about 100 eggs. The egg stage lasts 10–14 days in summer and 18–20 in winter. The young lice feed often and reach maturity and pair in 10 days, and the females begin to oviposit two days later. The adults can survive only a few days away from the host, but eggs rubbed off it may lie dormant for as long as 30 days before hatching, and pigs may acquire infestation from infested premises, though it is usually caused by direct contact. Notes are given on the economic importance of infestation by lice and mange mites, and a brief indication of the life-history of the mites [*R.A.E.*, B **29** 182] is included. The principal treatment recommended is spraying with a mixure of neatsfoot oil, water and washing soda for the control of lice [**29** 61], and with the same mixture with the addition of 2 oz. sulphur per gal. where mange is involved [*cf.* **29** 183]. If neatsfoot oil is not available, any oil of thin consistency and even a mixture of sump oil and kerosene (6 : 1) may be used. To eradicate lice, all pigs should be treated, the premises cleaned and disinfected if necessary, and the animals treated again after 12–14 days in summer or 18–20 days in winter. To eradicate mange, all pigs should be treated, and the lightly infested ones of market weight should then be sold at once for slaughter and the heavily infested ones destroyed. The remainder should then be treated every 14 days until cured; but none should be retained that remain infested after four treatments. Other control measures discussed are the use of dips where there are large numbers of animals, the provision of oiling posts and concrete wallows [**8** 200], which are considered to have limited value only, and hand treatment for small numbers.

The Sheep Blowfly and its Control.—*J. Dep. Agric. Vict.* **42** pt. 1 pp. 9–16, 1 col. pl., 7 figs. Melbourne, 1944.

The habits of the blowflies that infest sheep in Australia, the conditions that predispose sheep to attack, and the effects of strike are briefly reviewed, and accounts are given of the various measures that may be taken to prevent infestation and treat it when it has occurred. The chances of attack may be lessened by reducing the susceptibility of the sheep or the abundance of the flies. Methods of making sheep less susceptible include selective breeding, crutching or shearing, jetting, dipping or swabbing with solutions poisonous to the larvae, leaving the tail rather longer than usual and performing the modified Mules' operation [*R.A.E.*, B **32** 142], for which detailed instructions are given. Fly populations may be reduced by the collection and destruction of larvae when infested sheep are

treated. The method of preparing a recently recommended dressing [**32** 81], with which all strikes found should be treated, is described.

Lucilia cuprina, Wied., is responsible for at least 80 per cent. of infestations of sheep in Australia, and *Calliphora stygia*, F., and *C. augur*, F., which deposit eggs and larvae, respectively, also initiate infestation, while *Chrysomyia rufifacies*, Macq., *C.* (*Microcalliphora*) *varipes*, Macq., *C. micropogon*, Bigot, and *Sarcophaga froggatti*, Tayl., are secondary flies, attacking and developing in strikes started by the first group. The primary flies breed mainly on living sheep. They will also infest a fresh carcass, but secondary flies infest it as soon as it begins to decompose, and, as their larvae are more active and grow more rapidly than those of the primary flies, they prevent the latter from developing. In view of this, trapping and the destruction of carcasses are considered to be of little value in blowfly control.

WATERHOUSE (D. F.). **Field and Laboratory Tests with B.T.B. Blowfly Dressing and its Modifications, with special Reference to B.K.B.**—*J. Coun. sci. industr. Res. Aust.* **17** no. 1 pp. 1–15, 9 refs. Melbourne, 1944.

An account is given of experiments in Australia in which six promising and available sheep blowfly dressings were compared with B.T.B.30 and B.T.B.15, mixtures of boric acid, tar oil and bentonite containing, respectively, 30 and 15 per cent. boric acid [*R.A.E.*, B **30** 53 ; **31** 30]. Penetration was tested in moist fleece over a strike and in long and short dry wool. To test contact toxicity, prepupae of *Lucilia cuprina*, Wied., were immersed in the dressings for periods of 5 or 10 minutes, drained and placed in dry sand. The protective value of dressings was determined by applying them to struck areas of sheep, which were then exposed to a large population of gravid females of *L. cuprina* in an insectary where a temperature and humidity favourable for oviposition were maintained. The site of oviposition, the number of egg batches laid and the success with which the young larvae established themselves were recorded, and observations were continued until restrike occurred on all dressings. The two B.T.B. dressings, the emulsion of camphor oil and boric acid known as C.B.E. [**28** 103] and two commercial dressings had very good penetration and killed all larvae that remained in the infested area within 12 hours or less. The commercial dressings were slightly irritant and gave protection from reinfestation for only five days, whereas the other three did not cause any irritation and protected against reinfestation for 11–14 days. In no case was contact toxicity high. C.B.E. prevented oviposition for 24–48 hours, but B.T.B. was not a good repellent. The results obtained with a third commercial dressing, sodium pentaborate and a zinc-sulphate dressing [**28** 102] were inferior in almost all respects. The use of B.T.B. dressings on 250 field strikes confirmed the laboratory results, except that no reinfestation occurred.

As the tar-oil fraction originally recommended in the B.T.B. dressing had ceased to be available, tests were made with a number of tar and petroleum oils available in quantity as substitutes. The stability of each dressing, its power of penetration and the results of irritation tests are shown in a table. Dressings prepared with other tar oils did not penetrate so well as B.T.B.15, nor were they as stable. Of the mineral oils, three kerosenes produced very stable dressings that penetrated long wool as well as B.T.B. and short wool almost as well. Of these, power kerosene was cheap and produced a dressing of desirable consistency that penetrated well, was non-irritant, cleared wounds without the formation of excessive scab and prevented reinfestation. However, its contact toxicity was lower than that of B.T.B., and various mixtures of kerosene and tar oils were therefore tested instead of kerosene alone. A mixture of equal parts of power kerosene and creosote 259 or middle oil 43 was most satisfactory, though contact toxicity was still rather low [**32** 81] ; it was recommended as a

substitute for the original tar oil as a result of field tests in 1941. The results varied with the creosote used, but could not be correlated with its distillation range or its tar acid content. The contact toxicity of various commercially available essential oils and their emulsions was then examined and found to be very unsatisfactory, but that of orthodichlorbenzene was excellent. B.T.B. containing 2 per cent. of this in place of the tar oil caused complete mortality in 5 minutes, but showed poor stability and penetration. In view of this and the high contact toxicity of a lysol dressing described by Hobson [**29** 177], which, however, contained no stomach poison to protect against reinfestation and had other defects, dressings were prepared with various combinations of kerosene, orthodichlorbenzene, lysol, carbon tetrachloride and linseed soap substituted for the tar oil as the contact agent in the original B.T.B.15. The best results were obtained with a dressing containing 5·4 per cent. by weight orthodichlorbenzene, 5·3 per cent. lysol, 9·3 per cent. kerosene, 15 per cent. boric acid, 3 per cent. bentonite, 0·5 per cent. Agral 2 and 61·5 per cent. water. This caused complete mortality after immersion for only 30 seconds, and the increase in the amount of contact agent resulted in greater stability and penetration. This dressing (B.K.B.) gave very good results in 35 field tests and its use has been recommended. It is more expensive than B.T.B. Tests with a number of bentonites and similar substances showed the superiority of processed American clays over all other samples [**32** 81].

Torres Cañamares (F.). **Nuevas localidades de "** *Phlebotomus* **" en España y algunas observaciones sobre los mismos.**—*Rev. Sanid. Hig. públ.* **18** no. 1 repr. 10 pp., 2 figs., 3 refs. Madrid, 1944.

New distributional records are given for the five species of *Phlebotomus* known to occur in Spain. These are *P. papatasii*, Scop., *P. perniciosus*, Newst., *P. sergenti*, Parr., *P. minutus*, Rond. (*parroti* var. *italicus*, Adl. & Thdr.) and *P. ariasi*, Tonnoir [*cf. R.A.E.*, B **23** 280; **26** 76; **32** 67].

Papers noticed by Title only.

[Harris (W. V.).] **Annual Report of the Entomologist for the Year 1943** [including a record of *Anopheles keniensis*, Evans, near Morogoro].—7 pp. typescript. [Morogoro] Dep. Agric. Tanganyika, 1944.

Hart (J. W.). **A preliminary List of the Mosquitoes of Indiana** [24 species, including *Anopheles punctipennis*, Say, and *A. quadrimaculatus*, Say].—*Amer. Midl. Nat.* **31** no. 2 pp. 414-416. Notre Dame, Ind., 1944.

Davey (T. H.), Gordon (R. M.) & Unsworth (K.). **The Control of** *Notoëdres* **Infection in Rats by the Use of Soap impregnated with Tetraethylthiuram Monosulphide.**—*Ann. trop. Med. Parasit.* **38** no. 1 pp. 46-57, 8 refs. Liverpool, 1944. [For briefer account see *R.A.E.*, B **32** 146.]

[Blagoveshchenskiĭ (D. I.).] **Благовещенский (Д. И.). Faune de l'URSS. Mallophages des animaux domestiques.** [*In Russian.*]—*Inst. zool. Acad. Sci. URSS*, N.S. no. 27, viii+89 pp., 56 figs., 3½ pp. refs. Moscow, 1940. Price 8 *rub.* 50 *kop.* [Recd. 1945.]

Coon (B. F.). **Effects of paralytic Insecticides on Heart Pulsations and Circulation of the Blood in the American Cockroach** [*Periplaneta americana*, L.].—*Abstr. doct. Diss. Ohio Univ.* no. 40 pp. 29-33, 4 refs. Columbus, Ohio, 1943.

VAUCEL (M.). **Glossines du Cameroun Français.**—*Rev. Sci. méd. Afr. franç. libre* **2** no. 2 pp. 97–100, 19 figs. Brazzaville, 1943.

In 1939, *Glossina palpalis*, R.-D., *G. caliginea*, Aust., *G. pallicera*, Big., *G. tachinoides*, Westw., *G. morsitans*, Westw., *G. longipalpis*, Wied., *G. tabaniformis*, Westw., and *G. fusca*, Wlk., were known from the French Cameroons. Dissection of flies caught since then has shown the presence of *G. fuscipleuris*, Aust., of which 33 examples were taken at an altitude of 2,625 ft., *G. fusca* var. *congolensis*, Newst. & Evans, of which four were caught, and *G. haningtoni*, Newst. & Evans, of which 36 were taken in forest regions between 7 a.m. and 3 p.m. A few examples of the last-named were found in earlier collections labelled *G. fusca* or *G. tabaniformis*. The male genitalia corresponded exactly to the description of Newstead & Evans, but the signum of the uterus of the females differed considerably from that of the types from the British Cameroons and resembled much more closely that of a specimen described from the Belgian Congo. The sub-species *fuscipes*, Newst., of *G. palpalis* was found to be comparatively abundant, comprising 238 of a total of 1,577 of the species, which occurred in both forest and savannah. Most of the females of *G. tabaniformis* taken had the signum characterised by heavy chitinisation of variable shape on the distal part. The absence of chitinisation appeared exceptional. The genitalia of the males conformed with the usual descriptions.

FIASSON (R.). **Notes sur les parasites animaux du haut-Apure (Venezuela).**—*Rev. Sci. méd. Afr. franç. libre* **2** no. 2 pp. 125–151, 5 col. pls., 1 map, 20 refs. Brazzaville, 1943.

Most of this paper on parasites of animals in the State of Apure, the part of Venezuela where most stock is kept, consists of a list of Arthropods found there, supplemented in most cases with notes on their prevalence and hosts and sometimes their distribution, classification, etc. The ticks include *Amblyomma cayennense*, F., which is abundant in the dry season on a great variety of hosts, including man and domestic animals, *A. maculatum*, Koch, which was seen on horses, donkeys, cattle, dogs and pigs, *Dermacentor nitens*, Neum., which was taken on dogs, horses, mules and donkeys, *Rhipicephalus sanguineus*, Latr., which occurs on dogs, and *Boophilus annulatus microplus*, Can., which is the most abundant after *A. cayennense*, and was taken on cattle, horses, goats and dogs. *Psoroptes equi*, Hering, and *Haematopinus asini*, L., were common on horses, and *H. eurysternus*, Nitzsch, on cattle. *Ctenocephalides felis*, Bch., and *Tunga penetrans*, L., occur on man, and the latter also infests dogs in the dry season. One of the most troublesome Diptera attacking man is *Simulium haematopotum*, Mall. Of the eight Tabanids found, *Chrysops willistoni*, Hine, was much the most widespread at the beginning of the rainy season, when it was extremely abundant, attacking both man and animals. It breeds among rushes on damp but not flooded ground. It is believed to be the chief vector of *Trypanosoma venezuelense*, which is the cause of a serious form of trypanosomiasis in horses, donkeys and mules [*cf.* *R.A.E.*, B **17** 49]. The blood-sucking Muscids comprise *Stomoxys nigra*, Macq., *S. calcitrans*, L., which is commoner, and *Lyperosia irritans*, L., which was introduced into Apure from Colombia about the end of 1937 and is a serious pest of cattle. It is more abundant on the plains than in the woods, where the cow-dung in which it breeds is rapidly destroyed by Coleoptera. Horses were attacked to some extent. The egg and larval stages lasted 1–2 and 3–6 days in individuals reared in cow-dung on wet sand in bottles, and the complete life-cycle from egg to adult occupied about a month. Cattle and dogs were commonly infested by *Dermatobia hominis*, Say (*cyaniventris*, Macq.) and horses by *Cochliomyia hominivorax*, Coq.

(236) Wt. P6/3752 5/45 S.E.R. Ltd. Gp. 432. [8]

Osorno Mesa (E.). **Las garrapatas de la República de Colombia.** [The Ticks of the Republic of Colombia.]—*Rev. Fac. nac. Agron.* **5** no. 16–17 pp. 57–103, 1 map, 2 figs. Medellín, 1942.

Franco F. (R.). **Informe sobre el trabajo "Las garrapatas de la República de Colombia."**. . . [Discussion on the above paper.]—*T. c.* pp. 104–110.

The first of these papers has been noticed from another source [*R.A.E.*, B **30** 127]. In the second, the actual and possible relation of ticks to disease in man and animals in Colombia and elsewhere is discussed. The tick-borne diseases occurring in Colombia are relapsing fever transmitted by *Ornithodoros rudis*, Karsch [**31** 178], spotted fever [**32** 38–39 etc.] and piroplasmosis of cattle, caused by *Piroplasma bigeminum*, which has been found by the author in various parts of the country.

Vogelsang (E. V. [*i.e.* E. G.]). **Contribución al estudio de la parasitología animal en Venezuela. XV. Acarina de los animales domésticos y salvajes.** [Acarina of domestic and wild Animals.]—*Bol. Ent. venezolana* **3** no. 1 pp. 51–56, 1 pl., 8 refs. Caracas, 1944.

Lists are given of 15 mites found on wild and domestic mammals and birds in various parts of Venezuela. They include *Psoroptes equi*, Hering, which is the commonest mange mite of horses and occurs in epizootic form in the Pascua Valley (Guarico State) and Uracoa (Monagas) after the rains and floods, *Sarcoptes caballi*, Oudm. (*equi*, Gerl.), which causes fatal and very contagious mange of horses and was also observed in these two regions mostly after the rains, *S. suis*, Gerl., a serious pest of young pigs in the States of Guarico and Aragua, *S. canis*, Gerl., on dogs, *Demodex canis*, Leydig, which is particularly common on puppies and was once found infesting a horse, *Notoëdres cati*, Hering, on cats, and *Cytoleichus nudus*, Vizioli, *Laminosioptes cysticola*, Vizioli, *Cnemidocoptes mutans*, Robin & Lanq., and *Dermanyssus gallinae*, Deg., on fowls. *D. gallinae*, which is the commonest fowl mite, was also observed to attack man, and transitory infestations by a species of *Sarcoptes* occurred on the arms of two persons who carried out autopsies on infested foxes.

The Activities of the Department of Tsetse Research, Tanganyika Territory, since 1936 [to 1942].—32 pp. multigraph. [Dar es Salaam, 1943.]

The information on the activities of the earlier part of the period covered by this report has already been noticed from an earlier one [*R.A.E.*, B **30** 5–8]. As a result of population studies on *Glossina morsitans*, Westw., at Kakoma, C. H. N. Jackson concluded that a catch of one old male per 10,000 yards on a fly round indicated a population of about 7½ old males per square mile, and perhaps two or three times as many females [*cf.* **30** 5]. The male death rate is positively correlated with the saturation deficit and with the percentage of females in the catch of old flies. Routine examinations of many chosen breeding sites failed to afford data on seasonal rates of larviposition, because seasonal increase in breeding could not be dissociated from increased preference for the better shaded and more recognisable sites during the dry season. Even at this season, over 90 per cent. of the pupae were scattered singly in inconspicuous places. Continuous protection from fire in fairly short-grassed *Isoberlinia-Brachystegia* woodland at Kakoma reduced the fly population considerably in the first year, but later the numbers in the area from which fire had been excluded rose above those of the control. An escape fire prevented further observations but showed that fly did concentrate in the burnt areas, while in areas remote from the burnt land, population continued to fall.

Studies on *G. swynnertoni*, Aust., were carried out at Shinyanga. Observations by Jackson in an area where fire-exclusion had had least effect on the fly indicated that it has a greater tendency to disperse than *G. morsitans*

[*cf.* **29** 123]. In the older fire-exclusion blocks, however, it can maintain small communities in islands of favourable bush. Observations by F. L. Vanderplank showed a shortening of its hunger cycle in the dry season [*cf.* **25** 162]. H. M. Lloyd found that activity causes considerable loss of weight under natural conditions. While flies that could not move far lost only 1½ per cent. of their weight per hour, flies following walkers lost about 5½ per cent., and one fly that followed a car for 23 minutes lost at the rate of 16½ per cent. per hour. Preliminary experiments made by W. H. Potts and Vanderplank on the lines described by R. W. Jack & W. L. Williams [**26** 29] reproduced the reversal of the positive reaction to light when certain temperatures are passed, but showed that not only is the effect easily masked by preference for the lower temperature but the reversal is not easily or regularly obtained. In a series of experiments in which examples of wild *G. swynnertoni* and laboratory-bred *G. morsitans* were placed in the light chamber, the temperature of which was then raised to 37–40°C. [98·6–104°F.], most of the latter went to the dark chamber and died there when the temperature was raised sufficiently, whereas most of the former remained and died in the light chamber. It was not determined whether this indicates a difference between the habits of the two species or between those of wild and bred flies.

There is evidence that *G. swynnertoni* has definite preferences for different types of vegetation at different times of the year, concentrating in the short-grassed hardpan [**32** 187] during the latter part of the rains when grass is relatively long and spreading out into the better thicketed and shaded types of country in the dry season [*cf.* **24** 26] and early rains when grass is laid or burnt and just appearing. Statistical analysis of preliminary data obtained at Kitalala led [E. F.] Whiteside to conclude that abundance of game reduces the activity of the fly, though the contrary has often been suggested [*cf.* **30** 6]. Data from fly catches made for other purposes by Jackson at Shinyanga supported this conclusion. To obtain direct evidence, he arranged daily catches in the same stretch of country, the catchers being preceded on alternate occasions by a herd of about a dozen cattle. The catches made after the passage of the cattle did not differ from those made at other times, nor did the accidental passage of a herd of giraffe in front of the catchers on two occasions affect the results. Of 7,816 males of *G. swynnertoni* examined, 8, 214 and 191 were positive for *Trypanosoma brucei*, *T. congolense* and *T. vivax*, respectively, and the corresponding figures for 1,571 females were 0, 36 and 30. Ants of the genus *Pheidole* were almost wholly responsible for taking pupae placed in breeding-sites in the bush. More pupae were taken from unburnt than burnt country [*cf.* **30** 7] except in the first part of the long-grass season and probably at the end of the rains. Significantly more were taken from the long-grassed alluvial areas than the short-grassed hardpans, with the long-grass eluvial areas probably occupying an intermediate position. Pupae in classical sites were less vulnerable than those elsewhere.

Although fire-exclusion reduces *G. swynnertoni* and concentrates those individuals that remain in limited short-grassed areas, it became evident in 1940 that it could not alone exterminate the tsetse in a reasonable time. It was therefore attempted to render the hardpan areas unfavourable by felling the trees and thickets in them. The fly was reduced to occasional individuals over the whole block, and the reduction continues though there is no evidence of failure of the females to become fertilised normally. The way in which felling of the cover causes this reduction of the tsetse is discussed. The effect was first thought to be connected with the dry season, but later study showed that the fall in population seems to follow clearing irrespective of the season. A recent observation by Jackson confirmed earlier ones by Vanderplank that *G. swynnertoni*, when marked and released, settles on the shaded portions of the thicker branches of the trees up to about 10 feet above the ground, and it was thought that the destruction of these resting sites might cause such increase in activity as to

deplete the fat reserves of the fly. However, investigation failed to show any difference between the fat contents of flies from cleared and uncleared hardpan. The reduction was not caused by scarcity of food or difficulty in obtaining it.

Observations on *G. pallidipes*, Aust., were made at Shinyanga by Vanderplank and at Kilifi on the Kenya coast by J. Y. Moggridge. At Kilifi, density-activity was inversely related to the saturation deficit during the wet season, but high saturation deficits in a severe dry season also caused high density-activity. Both at Kilifi and at Shinyanga, density-activity fluctuated violently, but less variation was found at Shinyanga on paths cut through the thicket where the fly lives than on paths cut at random through the savannah bush. More flies were caught in the late afternoon than at other times at Shinyanga, but this was not so under Kenya coastal conditions. Both Vanderplank and Moggridge, in common with most observers, consider *G. pallidipes* reluctant to come to man. It is caught on man in large numbers only when density is great or conditions severe. Vanderplank found that screens attract significantly larger numbers than man and bait-oxen even more, but screens treated with extracts of animal scents attracted more than bait-oxen. At both Kilifi and Shinyanga, real density varied inversely with the saturation deficit. Vanderplank stresses the influence of the length of the hunger cycle in affecting the figures from the ordinary rounds. When correction is made for this, the fly rounds in the fly's habitat show the same seasonal picture as the true density.

At Shinyanga, the life of *G. pallidipes* was longest during the rains. During June 1940, the observed mean life for males was between 11 and 34 days and that for females between 16 and 48 days. It was shortest (between 5 and 16 days for males and between 7 and 20 for females) during October. Females formed 41 per cent. of the total catch with bait-oxen at Kilifi, and there was but little seasonal change in this percentage. At Shinyanga, they formed 49–57 per cent. in the dry season and 17–29 per cent. in the wet season. Vanderplank's population estimates indicate that the females are about 20 per cent. more numerous than the males. Moggridge found that females were influenced by temperature and saturation deficit in the same way as males. Only a few pregnant females were taken, principally during the wet season, but these showed no reluctance to attack. Activity at Kilifi varied with atmospheric humidity. Under the exceptionally hot and dry conditions late in a very dry season, the flies are forced to remain inactive for so long that, in order to satisfy their hunger, they show abnormal so-called panic activity during the periods of high humidity of the early morning. At Shinyanga, the relation between humidity and temperature on the one hand and activity on the other was more complicated. Activity increased with rising temperature up to 30°C. [86°F.] and decreased with further rises. However, temperature effects are bound up with the humidity of the air and other climatic factors. Very humid conditions encouraged activity at high temperatures but discouraged it at lower ones, while the reverse was true of very dry conditions. The fly was inactive at temperatures below 19°C. [66·2°F.]. Wind velocities and barometric pressure as recorded in the bush at Shinyanga had no effect upon activity, which was greatest at low light intensities and at low black-bulb temperatures.

Ox, dog and porcupine were attractive baits at Shinyanga. Vanderplank calculated a mean hunger cycle varying from about 5 days in the early dry season (June) to only $3\frac{3}{4}$ at the end of it (October). In the clump thicket country at Kilifi, which affords the nearest approach there to the conditions at Shinyanga, Moggridge found that the fly was more hungry in the dry season than in the rains. Vanderplank found indications at Shinyanga that its true home is thickets, and that it leaves these to feed during the early morning and late evening when the light intensity is low. There is some evidence that it feeds outside the thickets at night. It wanders in the wet season, but its movement is much more restricted in the dry season. Lloyd found it to be based on both the riverine thicket and on the drier, eluvial thicket at Kingolwira in the Eastern

Province. Under the prevailing mild conditions it can penetrate a mile into cleared country. Out of 2,458 males examined, 5, 70 and 64 were positive for *T. brucei*, *T. congolense* and *T. vivax*, and the corresponding figures for 1,640 females were 3, 42 and 33.

Moggridge reports from Kenya that afternoon catches of *G. brevipalpis*, Newst., exceeded morning ones if they were continued until dusk, when the greatest numbers were taken. In the forest, catches showed little variation from month to month or season to season, but elsewhere, when there were few flies, catches were greatest under severe dry season and very humid conditions, the latter influence being the more powerful. Females rarely appeared before dusk. The percentage of females in afternoon catches on bait-cattle in the forest was 7 in the wet season and 11 in the dry, the percentages in morning catches being 4·9 and 5·2, respectively. Lloyd records 40 per cent. females in catches on bait-cattle in the riverine habitat at Kingolwira. Moggridge concluded from the few pupae and pupal cases found that *G. brevipalpis* prefers logs and bases of thickets for its breeding sites, so that the pupae are probably scattered singly like those of *G. morsitans* and *G. swynnertoni*.

Data on *G. austeni*, Newst., are based on the work of Moggridge at Kilifi. The percentage of females in catches normally varied from 24 in the dry season to 32 in the wet in the morning, and from 36 in the dry season to 31 in the wet in the afternoon. Pregnant females attacked as readily as those of *G. pallidipes*. They were caught in greatest numbers in the wet season. Panic activity occurs during the short periods in the dry season when conditions permit, as in *G. pallidipes*, but the periods suitable for *G. austeni* are even shorter, so that feeding at night is necessary. As the flies do not appear to be adapted for night vision, it is concluded that the sense of smell must be used. Large numbers of pupae and cases were found, particularly among fallen logs, and it is thought unlikely that many larvae can be deposited outside such sites. The fly seemed to be replete at all times except under conditions of panic activity. There was a tendency to concentrate in denser vegetation in the wet season.

Information on *G. palpalis*, R.-D., is largely based on observations made in Kenya by Lloyd and [J. P.] Glasgow during an experiment on the destruction of this species, first by trapping and then by long-shore clearing, on Maboko Island in the Kavirondo Gulf of Lake Victoria between 1932 and 1941. There was evidence that fly-rounds are a good index of real density. Lloyd estimated that the traps caught 1½–2 per cent. of the old male population per day at the end of the dry season, but probably more during the rains. Traps reduced fly numbers markedly, but rapid recovery ensued whenever they were not used. About three-quarters of the trap catch was eaten by ants when the traps were cleared twice a week. Glasgow found that catches from a canoe represented only about a third of the old males and half the total flies taken on a simultaneous catch along the shore and that the flies were hungrier, but the catches of old males in the canoe varied less. The proportion of females is greater in trap-catches than in hand-catches, but rises with an intensive campaign of hand-catches. Many pregnant females enter the traps, but it was concluded that generally, as in the case of males, only the hungry females were caught. Observations by Thomson on Kimburu Island at the southern end of Lake Tanganyika near Mpulungu (Northern Rhodesia) confirmed H. E. Hornby's findings on Maboko Island that the food of *G. palpalis* is mainly reptilian blood, although there was no shortage of mammals on Kimburu. The long-shore clearing of a peninsula of Maboko Island to a width of 100 feet greatly reduced the fly population, probably through the destruction of the rest-haunt, as the food supply was not interfered with and evidence of breeding was found in the inland thicket that remained. Increased chance of attack by predators during the flight from the thicket to the water edge for feeding may have played a part [*cf.* **30** 118]. Thomson observed on Kimburu Island that *G. palpalis* persisted with the marginal vegetation cleared back to about 30 yards from the lake shore. Enough survived to

reinfest regeneration as soon as it occurred. Dense reed beds on a neighbouring island were incapable of maintaining *G. palpalis* unless backed by bush. Clearing along the shore in the Mpulungu area reduced the fly to very small numbers. Of 178 males examined by Hornby, 49 showed infection of the midgut with *T. grayi*. This is further evidence that the main food of the fly is reptilian. Thomson found 18 per cent. infection with *T. grayi* on Kimburu Island. In neither case were there other trypanosomes in the fly. A comparison showed that whereas hand-catching maintained its efficiency when numbers were low, traps did not.

In investigations on methods of rearing tsetse in the laboratory, Vanderplank showed that keeping the adults in the dark at a relative humidity of 80–90 per cent. prolonged their life appreciably. [J.] Ford showed that agitating pupae considerably lowered the percentage of emergence. Potts concluded that oil paints do not affect length of life in the laboratory [*cf.* **29** 161]. Dissection of flies from field catches at Shinyanga showed that, even in a much reduced population, unfertilised females are found only among freshly emerged flies, and even among these, a large number has already been fertilised [*cf.* **29** 1]. However, 25–33 per cent. of the females in laboratory jars are not fertilised, and many are poorly fertilised, whereas in the field a poorly fertilised female is rare. Most larvae are deposited in the late afternoon and evening under laboratory conditions. Glasgow found that adults emerge at temperatures as low as 18–19°C. [64·4–66·2°F.]. In two experiments by Ford, 65 and 7 per cent. of pupae weighing over and under 25 mg., respectively, and 72 and 0 per cent. of pupae weighing over and under 20 mg., gave rise to adults. Observations in the laboratory showed that the black lobes of the larva were visible through the ventral skin of the abdomen of the female for 1½ days before larviposition. Of 86,000, 26,000 and 2,700 pupae from three districts in Tanganyika, 1½, ¾ and 6 per cent. were parasitised. *Thyridanthrax abruptus*, Lw., *T. argentifrons*, Aust., and *T. lineus*, Lw., formed 11, 22 and 6 per cent. of the parasites, the remainder being unidentifiable.

Lists of items of tribal reclamation done under the aegis of the Department and of publications by members of the Department during the period under review are appended.

Soysa (E.) & Jayawardena (M. D. S.). **Pulmonary Acariasis : a possible Cause of Asthma.**—*Brit. med. J.* no. 4383 pp. 1–6, 8 refs. London, 1945.

From June 1942 to June 1944, bronchial asthma was responsible for 48 per cent. of respiratory cases and for 21 per cent. of all cases invalided out of the Army through the medical division of a military hospital in the South-East Asia Command. In view of a recent paper [*R.A.E.*, B **33** 11] and of a record of a case of asthma in a civilian in whose sputum mites were present and who made a remarkable recovery on treatment with pentavalent arsenic, the authors investigated 30 military cases. They give the case records and the results of aetiological, clinical and pathological observations. Almost all the soldiers concerned had been associated with places, chiefly ration stores, where they were exposed to inhalation of mites. Blood examination showed a constant eosinophilic leucocytosis with massive eosinophilia in many of them. The sputum of 21 of the men was examined, and mites (either *Tyroglyphus* or *Tarsonemus*) were found in 11. Treatment was in two stages, first with the usual anti-asthmatic remedies (which gave appreciable relief in only two cases) and then by oral administration of pentavalent arsenic (stovarsol or carbarsone) for periods varying from 6 to 33 days. The arsenic treatment was effective ; the criterion of cure was not the control of the clinical condition (which was generally effected in 7–10 days) but a satisfactory reduction of the eosinophil count, which was delayed when carbarsone was used. A check nine months after

the first patient had been discharged from hospital showed no recurrence of asthma in any of the cases, and re-examination of several of them showed a normal haematological condition.

MELLANBY (K.). **Scabies Prophylaxis using " Tetmosol " Soap.**—*Brit. med. J.* no. 4384 pp. 38–39, 4 refs. London, 1945.

An account is given of an experiment in which soap containing 10 per cent. tetraethylthiuram monosulphide (tetmosol) [*cf. R.A.E.*, B **32** 146] was used for the control of *Sarcoptes* [*scabiei*, Deg.] over a period of 11 weeks in a mental hospital. The tetmosol soap was issued to 705 patients of whom 93 (13·2 per cent.) were infested, while 1,213 patients living in other blocks or wards, of whom 18 (1·5 per cent.) were infested, continued to use unmedicated soap. Among the 705 patients using tetmosol, the numbers with scabies had decreased to 9 (1·3 per cent.) after 6 weeks and remained at this figure after 11 weeks, while no new cases occurred. Among the 1,213 using ordinary soap the numbers with scabies had increased to 26 (2·1 per cent.) after 6 weeks and 42 (3·5 per cent.) after 11 weeks. None of 46 men and only three of 660 women were sensitive to the tetmosol, and the resulting rash disappeared quickly when its use was discontinued.

BLANC (G.) & BALTAZARD (M.). **Sur le mécanisme de la transmission de la peste par** *Xenopsylla cheopis*.—*C. R. Soc. Biol.* **136** no. 19–20 pp. 646–647. Paris, 1942. [Recd. 1945.]

It is generally considered that a flea does not transmit plague unless its proventriculus is blocked by the bacilli [*cf. R.A.E.*, B **26** 87–88; **27** 236, etc.]. The authors question this and describe an experiment in which a single batch of *Xenopsylla cheopis*, Roths., starved for a fortnight after emergence and then given infective meals, transmitted plague to a succession of healthy guineapigs over a period of three months. The fleas lived as long as others kept under similar conditions on uninfected animals. If they were blocked, they must have remained so for three months or else have become blocked successively although they were infected from the first, both of which suggestions seem improbable. It is concluded that the important factor in transmission is the multiplication of the bacilli in the digestive tract of the flea. Experiments show that infected individuals of *X. cheopis* seldom transmit the infection at their first meal after fasting for a fortnight, but are usually able to do so less than 12 hours after the meal. Apparently the fresh blood enables the bacilli to multiply. The fact that *X. cheopis* cannot ordinarily transmit plague when hungry has an important epidemiological significance, as only hunger of some duration will induce it to attack man.

GIRARD (G.). **Les ectoparasites de l'homme dans l'épidémiologie de la peste.**—*Bull. Soc. Path. exot.* **36** no. 1–2 pp. 4–43, 1 pl., 1 fig., 67 refs. Paris, 1943.

BLANC (G.) & BALTAZARD (M.). **Quelques remarques à propos du mémoire de G. Girard sur les " Ectoparasites humains dans l'épidémiologie de la peste."** —*T.c.* no. 7–8 pp. 208–217, 5 refs.

It is stated in the first paper that Blanc & Baltazard, studying the epidemiology of plague in Morocco [*cf. R.A.E.*, B **31** 234] concluded that endemicity gives place to epidemic conditions only when transmission from man to man occurs, either directly in the case of pneumonic plague or through the agency of ectoparasites of man in that of bubonic and septicaemic plague, the extent of the epidemic in the latter case being a function of the density of these ectoparasites. This was contrary to the usual view that rodents are the only important source of infection and rodent fleas the only important vectors.

The literature from 1894 onwards on the part played in the transmission of plague by ectoparasites of man, including *Pulex irritans*, L., *Pediculus humanus*, L. (*corporis*, Deg.), *P. h. capitis*, Deg., and *Cimex lectularius*, L., is reviewed and discussed at some length, with particular reference to observations made in Morocco and to the author's experience in Madagascar.

In Morocco, Blanc & Baltazard observed that *Pediculus humanus* and *Pulex irritans* almost always become infected when they feed on a dying patient during the period of septicaemia. The louse remains infected for at least seven days and its excreta are infective for at least nine. The flea remains infected for at least 21 days and its excreta are infective for at least five days under natural conditions. Infection can be acquired from the excreta through a mucous membrane [*loc. cit.*]. Infected lice and fleas transmitted plague, but the manner in which they did so is not known. From present knowledge, it would seem that it must be by means of the excreta. *P. irritans* has not been shown to be susceptible to blocking.

In Madagascar, the absence of a murine epizootic since 1921, together with the known carriage of infection over a great distance by man, at first caused *P. irritans* to be considered the chief vector. However, collections of fleas made in dwellings with an apparatus developed by Estrade [**22** 156] resulted in the finding of large numbers of " free " examples of *Xenopsylla cheopis*, Roths., apart from rats or their nests. Mice and guineapigs infected by inoculation with material from lots of 1–60 of these fleas always died within 3–5 days of acute plague, and it was concluded that *X. cheopis* is almost the sole vector [*cf.* **28** 191 etc.] able to transmit plague from rat to man and from man to rat. Failure to catch it on a rat exposed as bait suggested that individuals that live in the larval and pupal stages in the dust of human habitations lose their zootropism. Five years' experiments with small numbers of *P. irritans* taken in houses where fatal cases had occurred failed to reveal infection. Man has been mainly responsible for spreading plague over long distances, but when foci have subsequently been established, infected rats have always been found, the infection having presumably been passed from man to rat by *X. cheopis*.

In a series of comments, the author questions whether lice and fleas can become infected on all patients nearing death, as the bacilli in the blood are not usually sufficiently numerous. The percentage that can become infected is small, but this is unimportant in comparison with the actual number that do so, which depends on the density of infestation. This is particularly great in Morocco. Other subjects discussed include the importance of blocking [*cf.* preceding abstract], the difficulty of explaining the absence of bubonic plague during epidemics of the pneumonic form if the hypothesis of Blanc & Baltazard is accepted, the fact that plague resulting from infection by *P. irritans* in their experiments and in one by others [**17** 104] was of a sub-acute or chronic type, and the importance of " free " rat fleas in Morocco, where they are known to occur. The author shows that many ectoparasites (chiefly fleas) can adapt themselves for varying periods to hosts other than their usual ones and that the term ectoparasites of man in this connection should include *X. cheopis*, which readily attacks man. The classical theory and that of Blanc & Baltazard then become compatible.

In their reply, Blanc & Baltazard submit that even if only a few of the fleas that bite a person dying of plague become infected, they suffice to spread the disease if they are capable of transmitting it. Moreover, the proportion of ectoparasites that is infected may well be considerable as transmission was sometimes effected with quite small numbers. The usual failure of *P. irritans* to transmit plague to laboratory animals is due to its reluctance to feed on them. The theory that *Pediculus humanus* and *Pulex irritans* transmit plague by their excreta only is rejected, and experiments with *X. cheopis* [**33** 59] are cited as evidence that fleas can transmit without being blocked and remain infective for long periods, but seldom transmit during the first feed after fasting. Examples

of *P. irritans* from the rooms of patients and the clothes of persons who had died of plague transmitted it to guineapigs on which they fed through bolting silk that retained the excreta, and laboratory experiments confirmed this. *Haematopinus suis*, L., also transmitted plague from infected to healthy guineapigs by biting. In reply to the statement that *P. irritans* produced only subacute or chronic plague in their experiments, the authors submit that the fleas used were not all infected and had been kept without food for several days. This would account for their low infectivity. Fresh fleas infected by one meal on man and then fed on cured cases for nine days caused an infection in a guineapig that was fatal in three days. Moreover, infection caused by the injection of suspensions of *X. cheopis* from the same rooms into guineapigs was usually sub-acute also, presumably for the same reasons. Two batches of 25 examples of *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., from an infected dog and one batch of three of *C.* (*C.*) *felis*, Bch., from an infected cat caused fatal plague when injected into white rats. In one region, cases of plague in cats were frequent. A passage from a work by Wu Lien-teh is quoted to refute Girard's statement that cases of bubonic plague do not occur in pneumonic epidemics.

In support of the view that ectoparasites of man are the main vectors responsible for epidemics of plague, the authors cite evidence that, even when an intense murine epizootic is in progress and infected rat-fleas are numerous, these do not bite man unless rats are not available, and also point out that, since there is no reason to suppose that *X. cheopis* was more abundant in Europe between the fourteenth and eighteenth centuries than it is now, other vectors must have been concerned in the epidemics of plague that occurred then.

GRENIER (P.). **Observations sur quelques stations de simulies. Parasites et prédateurs des larves et nymphes.**—*Bull. Soc. Path. exot.* **36** no. 3–4 pp. 105–110, 1 pl., 12 refs. Paris, 1943.

Larvae of Simuliids (*Simulium ornatum*, Mg., *S. equinum*, L., and *S. aureum*, Fries) were abundant in water courses in two districts of northern France in 1942. Sporadic cases of infection by Protozoa (*Thelohania* and *Coelomycidium simulii*) were observed in them, but the percentage of infected larvae was never more than five [*cf. R.A.E.*, B **27** 250]. By the end of autumn, a heavy growth of algae and Vorticellids on the substratum had resulted in the almost complete disappearance of the larvae from the breeding place in which they had been most numerous in spring and summer. In some places, small larvae of Hydrachnid mites were found on the abdomens of pupae of *S. ornatum* inside the cocoons, sometimes as many as 15 on one pupa. No lesions were observed to be associated with these small larvae, but the abdomens of some pupae were completely emptied and large Hydrachnid larvae were present in the cocoons. When *S. ornatum* and *S. equinum* occurred together, the pupae of the former were heavily parasitised by the mites, while those of the latter were rarely attacked, on account of the close texture of the cocoon. Larvae and pupae of Chironomids were found in large numbers in the breeding places of *Simulium*. They may prevent the emergence of adult Simuliids by congesting the respiratory filaments of the pupae and preventing the absorption of sufficient air. Surrounded filaments in *S. ornatum* were often intact, but in *S. equinum*, they were sometimes completely destroyed. The presence of Chironomid larvae on Simuliid eggs indicates that they may feed on them. Larvae of Trichoptera of the genus *Rhyacophila* often devoured Simuliid larvae, and pupae of *Agapetus* were found with larvae of *S. aureum*. A thrips in good condition was seen in a cocoon of *S. ornatum* and another of the same species among a batch of larvae and pupae.

The effectiveness of parasites and predators in controlling Simuliids is discussed. It is concluded that effective control even by voracious predators is unlikely on account of the prolific breeding of the Simuliids, but good results

might be obtained from the transfer of large numbers of larvae infected with Protozoa. However, modifying the substratum holds the most promise. Simuliids were not found in parts of streams that had been regularly cleared of their vegetation, but were abundant in parts that had not been cleared.

ROUBAUD (E.) & TREILLARD (M.). **Observations sur les moustiques de la Crau. II. L'*Aëdes* (*Ochlerotatus*) *detritus* Hal.**—*Bull. Soc. Path. exot.* **36** no. 3–4 pp. 94–101, 19 refs. Paris, 1943. **Etudes sur les moustiques de la Crau. III. Recherches expérimentales sur les peuplements halophiles du Delta du Rhône.**—*T. c.* no. 5–6 pp. 150–154, 2 figs., 4 refs.

Notes are given in the first paper on the distribution and generations of *Aëdes detritus*, Hal., in France and elsewhere. Activity apparently continues through practically the whole year in Crau [*cf. R.A.E.*, B **31** 14]. Young and older larvae were found in May, July and at the beginning of October in saline breeding places near the coast, and females attacked man in November and December. Adults are also found in the interior of Crau in afforested areas as much as 12½ miles from their known saline breeding places. Their origin is discussed. The adults from the coastal areas had a dense covering of light-coloured scales on the dorsal surface of the abdomen, whereas those from the interior had very few of these scales and consequently appeared much darker. Experiments are described showing that drying is a necessary prelude to hatching of the eggs, which can withstand being dry for considerable periods. Through alternate drying and wetting, eggs laid at the same time by the same female can hatch at very different times, so that it is impossible to distinguish generations.

In the second paper, an account is given of experiments in which progeny of females from the interior were reared in fresh and saline water and progeny of females from the coast in fresh water. The density of the light scales on the body, legs and wings, and particularly the dorsal surface of the abdomen, was thus shown to be an inherited characteristic unaffected by the nature of the water in which the larvae had developed. It is concluded that there are two distinct biotypes, one dark and breeding in fresh water and the other light and breeding in saline water. The fresh-water breeding places have not been found. Adults of the light type have never been seen far inland.

LWOFF (M.) & NICOLLE (P.). **Recherches sur la nutrition des réduvidés hémophages. II. Besoins alimentaires des adultes de *Triatoma infestans* Klug dans les conditions habituelles d'élevage. Fécondité des femelles.**—*Bull. Soc. Path. exot.* **36** no. 3–4 pp. 110–124, 2 figs., 6 refs. Paris, 1943.

NICOLLE (P.) & LWOFF (M.). **Recherches sur la nutrition des réduvidés hémophages. III. Alimentation artificielle de *Triatoma infestans* Klug au moyen de sang défibriné hémolysé.**—*T.c.* no. 5–6 pp. 154–167, 8 figs., 5 refs.

The first of these papers deals with studies on adults of *Triatoma infestans*, Klug, fed on guineapigs. They did not feed whenever they were given the opportunity if this was at very frequent intervals. Females appeared to require large meals at intervals of 4–5 days to maintain a more or less constant weight, but males maintained their weight if fed every 8–10 days. Varying the intervals between meals within the limits of 1–10 days did not appreciably affect fecundity.

The second paper contains the results of investigations on the development of *T. infestans* when fed by means of Nicolle's apparatus [*R.A.E.*, B **30** 178] on blood that was haemolysed and warmed after it had been defibrinated and kept on ice. The technique is described. The nymphs differed little in weight or speed of development from others reared on guineapigs [**31** 134] until they reached the fifth instar, in which they were lighter and developed more slowly.

The rate of mortality was irregular on guineapig, but increased with each instar on artificial food. Many of the adults that had been reared on the latter refused to feed, and pairing and oviposition did not occur.

MARNEFFE (H.), RANQUE (J.) & SAUTET (J.). **Quelques points de la biologie de l'*Anopheles* (*Myzomyia*) *gambiae* dans la vallée moyenne du Niger.**—*Bull. Soc. Path. exot.* **36** no. 7–8 pp. 223–226, 6 refs. Paris, 1943.

Out of 251 females of *Anopheles gambiae*, Giles, from the valley of the Middle Niger in the French Sudan submitted to the precipitin test, 55·5 per cent. were positive for human blood. The technique of the test is described. The maxillary index of some of the mosquitos was determined and found to be 15–17 in most cases. In the discussion on this paper, E. Roubaud states that this maxillary index is high for a truly anthropophilous species [*cf. R.A.E.*, B **10** 53, etc.] and suggests that *A. gambiae* may be maintained by game in uninhabited regions. He had been attacked by it in such a place.

SAUTET (J.) & MARNEFFE (H.). **Contribution à l'étude de l'exophilie de divers anophèles vecteurs du paludisme au Liban et au Soudan français.**—*Bull. Soc. Path. exot.* **36** no. 7–8 pp. 226–229, 3 refs. Paris, 1943.

During a study in Lebanon of the occurrence of malaria vectors out of doors, males and engorged females of *Anopheles maculipennis* var. *sacharovi*, Favr, were found on several occasions in caves and tree holes and females attacked man avidly even in full daylight ; females of *A. sergenti*, Theo., were found in holes in a wall remote from habitations after a fruitless search for Anophelines had been made in the houses of a highly malarious suburb of Beyrout ; and adults of both sexes of *A. superpictus*, Grassi, were found twice in fair numbers in wall holes and also in an underground cavity near Beyrout, where it was associated with *A. sergenti*.

A similar study was made on *A. gambiae*, Giles, in the French Sudan, principally near Bamako in August and September. Outdoor resting places were easily found. Males and engorged and unengorged females were abundant in crevices in trees, and the females tended to bite at nightfall. Other outdoor resting places were straw latrine huts and the roofs of open, rustic shelters in piggeries. The conditions required in such resting places, the use of which does not seem to be restricted to the day-time, are protection from light, from excessive dryness or humidity and from wind. These studies and a similar one in Corsica [*R.A.E.*, B **25** 235] have shown that Anophelines reputed to be domestic in habit can adopt outdoor resting places without losing their tendency to bite man.

CALLOT (J.) & DAO VAN TY. **Sur quelques souches françaises de *Culex pipiens* L.**—*Bull. Soc. Path. exot.* **36** no. 7–8 pp. 229–232, 1 ref. Paris, 1943.

The two biological races of *Culex pipiens*, L., usually distinguished in France are *C. p. pipiens*, which is rural, eurygamic, non-autogenous and feeds on birds and *C. p. molestus*, Forsk. (*autogenicus*, Roub.) which is usually urban, stenogamic, autogenous and anthropophilous [*R.A.E.*, B **21** 267]. The authors, however, have reared and studied three strains that are stenogamic but non-autogenous. Females of two of these strains, which came from Richelieu (Indre-et-Loire) and Paris, respectively, would not feed on man, but those of the third, which originated from engorged females taken in August in an inhabited house in the south of France, attacked man readily, although they would also feed on fowls. This strain thus resembles *C. p. berbericus*, Roub. [*cf.* **21** 267 ; **27** 213]. One blood-meal was enough to ensure oviposition, which occurred 5–6 days later. The egg and larval stages lasted two and an average of 13 days,

respectively, at laboratory temperature, and males emerged from the pupae after two days. *C. pipiens* is very aggressive in rural areas near Nice, where it breeds in large reservoirs polluted with vegetable matter, but at Richelieu it does not attack man. A stenogamic non-autogenous strain had already been recorded from Richelieu by E. Brumpt. It is concluded that there must be at least three if not four biological races in France. The appearance of anthropophilous tendencies in the stenogamic non-autogenous race may be a geographical variation.

ROMAN (E.). **Toxicité vis-à-vis des larves de moustiques de quelques insecticides solubles ou émulsionnables.**—*C. R. Soc. Biol.* **137** no. 15–16 p. 499. Paris, 1943.

In studies to find a larvicide that would destroy mosquito larvae in septic tanks without affecting the bacteria, 5 per cent. rotenone in acetone used at a concentration of 2·5 parts rotenone per million in a neutral medium killed all larvae of *Culex pipiens*, L., in five hours without hindering bacterial development. With half this concentration, one larva and one pupa out of 20 were alive after three days. With the higher concentration, all larvae died within 2½ hours in an acid medium, but one larva was still alive after six hours in an alkaline medium. An emulsifiable preparation of pyrethrins gave complete control of larvae in five minutes at 1·25 parts per thousand and in six hours at 0·3 parts per thousand, and was not antiseptic at these concentrations, but favoured bacterial growth through the destruction of the larvae. Pyrethrins, however, are too expensive to be practical. Sodium fluoride destroyed bacteria at a concentration (1 : 5,000) that did not kill the larvae.

GOODHUE (L. D.). **Insecticidal Aerosols.**—*J. econ. Ent.* **37** no. 3 pp. 338–341. Menasha, Wis., 1944.

This paper contains a summary of the information on insecticidal aerosols given in earlier publications [*cf. R.A.E.*, B **30** 70 ; **31** 167, etc.], with the addition of recently collected data. For the liquefied-gas method, dichlordifluoromethane (Freon-12) is the most suitable propellent known, having a convenient pressure, a low heat of vaporisation and a low surface tension and being non-toxic to man and the higher animals and non-inflammable ; it is a poor solvent for many insecticides, but a mutual solvent can be used. Methyl chloride is also a good propellent, but is toxic to man and weakly inflammable ; it is cheaper than Freon and a more general solvent for insecticides. Dimethyl ether and propane, which produce good aerosols, are too inflammable for general use, but, like methyl chloride, can be used to dilute Freon up to the point of inflammability. The content of pyrethrins in the solution of pyrethrum extract and sesame oil in Freon most extensively used as an aerosol [**31** 167] has been reduced to conserve pyrethrum ; this has decreased its effectiveness against flies [*Musca domestica*, L.], but it is hoped to add other materials to correct this deficiency. Enough pyrethrum should be retained to give a paralytic action.

Research on the physical properties of aerosols has shown that the spraying properties of the solution are very important, since the efficiency of the aerosol depends on how it is formed. Liquid insecticides are best, but solids can be applied if they are dissolved in a good high-boiling solvent ; without it the solid may be deposited at the spraying orifice and block it. Moreover, liquid insecticides or solutions of solids do not coagulate so rapidly after being suspended in air, and they may have a more rapid physiological action on insects. The high-boiling solvent may also increase the solubility of the insecticide in the liquefied gas, which is important, since aerosols are produced only from true solutions in the liquefied gas, not from colloidal suspensions. The particle

size of the aerosol, measured by the settling rate, can easily be controlled by the amount of non-volatile material included ; when Freon is used, the optimum particle size appears to be that produced by 15 per cent. non-volatile material. It is pointed out that the saturated vapour above the liquid in the container has considerable weight and must be taken into account when the solutions are prepared and transferred from one container to another, and even during the dispensing of the solution if it is necessary to know the exact concentration. As the solution is discharged from the container, the concentration of what remains increases, so that when 90 per cent. is removed the concentration of the remainder is 8 per cent. higher than that of the original solution. The lowering of vapour-pressure caused by a solute such as sesame oil in Freon is so slight that it is of no consequence in the practical use of the aerosol ; 15 per cent. oil reduces the pressure by only 36 mm. out of a total pressure of about 5,000 mm. The density of the solution is important in certain calculations, especially those involving the capacity of a container. The energy required to disperse the material varies with the surface tension and viscosity, but these characteristics have not yet been investigated.

Methods of testing the aerosols are described. They are recommended for use on all aeroplanes to prevent the spread of disease-carrying mosquitos, and a single test showed that mosquitos and flies can be eliminated from a factory with a capacity of 27 million cu. ft. without interrupting the regular work. Pyrethrum is about twice as toxic to normal flies in aerosol form as when applied in a spray, but the rate of knock-down is slower.

MUNRO (J. A.). **Farm Stock Insecticides.**—*J. econ. Ent.* **37** no. 3 pp. 350–351. Menasha, Wis., 1944.

An account is given of experiments already noticed [*R.A.E.*, B **32** 100] in which effective control of lice on cattle in North Dakota was given by dusts containing 0·25–1 per cent. nicotine in wettable sulphur. It is here stated that the best source of nicotine was found to be Black Leaf 155 [14 per cent. nicotine fixed on a bentonite carrier]. The 1 per cent. nicotine dust gave encouraging results in the control of sheep " tick " [*Melophagus ovinus*, L.].

ALLEN (T. C.), DICKE (R. J.) & HARRIS (H. H.). **Sabadilla, *Schoenocaulon* spp., with Reference to its Toxicity to Houseflies.**—*J. econ. Ent.* **37** no. 3 pp. 400–408, 3 figs., 30 refs. Menasha, Wis., 1944.

Among the more promising of several plant materials tested as substitutes for pyrethrins and rotenone in the control of insects were the seeds of the plants known as sabadilla (*Schoenocaulon* spp.). Notes are given on the systematic position, appearance, popular names and distribution of these plants, and literature on their use as insecticides in the past is reviewed. Of the 20 recognised species, three occur in the United States, 19 in Mexico and one (*S. officinale*) in Central and South America. The active constituent of sabadilla seed is probably a complex group of alkaloids commonly referred to as veratrine, which melts at 140–155°C. The solubility of veratrine in various substances is given, and tests on the toxicity of kerosene extracts of sabadilla seed to *Musca domestica*, L., by the turntable method [*R.A.E.*, B **26** 246] are described. The samples studied comprised whole and powdered seed of unidentified species from various sources, including Mexico and Venezuela, and whole seed of *S. officinale* from Venezuela and *S. drummondi* and *S. texanum* from Texas. Some of those obtained as powder showed a knock-down and toxicity that compared favourably with the Official Test Insecticide when they were extracted at the rate of 1 lb. per U.S. gal. kerosene and at a temperature of 25°C. No lots of freshly powdered seed extracted at this temperature at the rate of 4 lb. per U.S. gal. were effective, but the toxicity of all inactive samples was increased by raising the temperature at which the extraction was carried out. The

first increase in toxicity occurred above 75°C. and the optimum temperature was 150°C. All the samples tested were much more effective than the O.T.I. when they were extracted at 150°C. at the rate of 1 lb. per U.S. gal. The application of the same amount of heat to the freshly powdered seed, which was then extracted with kerosene at 25°C., and treatment of the powdered seed with soda ash [sodium carbonate] before extraction also increased the toxicity of inactive samples considerably. The combination of the soda treatment with extraction at about 60°C. would apparently be as effective as extraction of untreated seed at 150°C. The toxicity of powdered seed increased with age during storage in the dark, but the aged material was unstable. The whole seed was quite stable under storage. Kerosene extracts retained their toxicity in brown glass containers for two years at 25°C., but extracts exposed to light deteriorated rapidly. The toxicity of *S. drummondi* and *S. texanum* was comparable to that of the species from more tropical zones. Extracts were also prepared, with or without heat, from the roots, bulbs, leaves and stems of *S. officinale* and *S. drummondi*, but they showed no toxicity. It is concluded that kerosene extracts of sabadilla seed are promising for the control of house-flies, but their application may be limited because of the sternutatory action produced during inhalation of the spray suspension.

Atkeson (F. W.), Borgmann (A. R.), Smith (R. C.) & Shaw (A. O.). **Relative Effects of several Base Oils used in Livestock Sprays on the Skin of Cattle.**—*J. econ. Ent.* **37** no. 3 pp. 419–428, 19 refs. Menasha, Wis., 1944.

The literature on the effects of oils used in livestock sprays on the skin of cattle is reviewed, and an account is given of tests made in Kansas in 1941 and 1942 on the reaction of the skin of dairy cows to certain livestock spray materials. In the first year, a widely used commercial livestock spray, two widely used base oils and combinations of toxic ingredients in one of the base oils were compared, each on 3–4 heifers. The animals were sprayed on 30 consecutive days at the rate of about 40 cc. per 1,000 lb. bodyweight. They were not protected from sun or rain. All the treatments caused some injury, but in no case was it serious. Individual heifers varied in reaction, and differences between the effects of some of the treatments were noticeable, but the toxic ingredients had little or no effect on the action of the base oil with which they were used.

During the second year, 17 base oils, the properties of which are shown, were compared under more controlled conditions by spraying four areas, each one foot wide and two feet long, on the same animal with four different oils. The oils were applied daily for 30 days at the rate of 10 cc. per area (about 200 cc. per 1,000 lb. of live weight for the entire animal) during the first trial and daily for 20 days at half that rate during the second trial. When applied at the latter rate, which is higher than that recommended in practice, two of the oils caused slight reactions, while the others caused none. Used at the higher rate, the oils showed marked differences. By the 30th day, eight of them had done noticeably more harm than the others, seven of which caused slight damage, while two were innocuous. Various properties of oils are defined. The most useful as an index of the effect on the skin was the unsulphonated residue content. Oils containing 92·5–100 per cent. unsulphonated residue included all the most satisfactory ones with one exception, while oils containing 87·5 per cent. or less were the least satisfactory. Contrary to published statements, the Saybolt viscosity of an oil was not a reliable index of skin reaction in these tests.

Atkeson (F. W.), Smith (R. C.), Borgmann (A. R.) & Fryer (H. C.). **Comparative Toxicity under Barn Conditions of Livestock Type Fly Sprays made from various Combinations of toxic Ingredients and Base Oils.**—*J. econ. Ent.* **37** no. 3 pp. 428–435, 19 refs. Menasha, Wis., 1944.

The literature on the testing of livestock sprays is reviewed, and an account is given of experiments carried out in Kansas in July–September 1942 on the

toxicity of 16 such sprays to flies in a modern dairy barn. They comprised two extensively used commercial preparations and 14 sprays of known composition, all consisting of various combinations of toxic ingredients and base oils except one in which water was the base. The capacity of the barn was about 11,500 cu. ft., and each spray was applied from an overhead system at the rate of 1 cc. per 36 cu. ft., or about half the amount prescribed for the Peet-Grady test [*cf. R.A.E.*, B **32** 106]. Doors and windows were closed, but not ventilators. The cattle were kept in the barn during the tests. House-flies [*Musca domestica*, L.] were exposed in six wire-gauze cages for 30 minutes and then removed. Each test was carried out three times, and all data on the knock-down and kill of the flies were analysed statistically.

Knock-down counts made 5 and 30 minutes after spraying ceased did not differ significantly. The differences between the knock-down efficiencies of the best five sprays were not significant, but highly significant differences existed between the better and poorer sprays. Lethane 384 (50 per cent. *n*-butyl carbitol thiocyanate by volume standardised with kerosene) and Thanite (secondary terpene-alcohol thiocyanyl acetate) were among the sprays giving the best knock-down. Thanite in water was significantly less effective than Thanite in oil, but better than some of the other oil-base sprays. Pyrethrum in concentrations of up to 6 per cent. of a 20 : 1 concentrate had generally the lowest knock-down efficiency, but when fortified with 5 per cent. D.H.S. Activator (ethylene glycol ether of pinene) it was among the best sprays at 3·75 per cent. or more of the concentrate. One of the two commercial sprays ranked last and the other about midway in knock-down efficiency. Oils of low Saybolt viscosity appeared superior in knock-down effect to those of higher viscosity.

As regards kill, the best four sprays were equal and significantly better than the next three, which were significantly better than the best of the others. Differences between the best and worst were very highly significant. Though Thanite in water was less effective than Thanite in oil and came eighth in order of effectiveness, its superiority over the four least effective oil-base sprays was highly significant. Pyrethrum and Lethane were among the least lethal sprays, but when 5 per cent. D.H.S. Activator was added to a pyrethrum spray containing 3·75 per cent. or more of a 20 : 1 concentrate, it was among the most efficient. The commercial spray that gave the poorest knock-down fell in the second best group in killing power, while the other was among the least effective. Two of the oils used apparently made the sprays irritating to the eyes and nose of the operator, and one of them caused the cows to cough. Three of the four most toxic sprays were among the five that gave the best knock-down, and three of the four least toxic among the poorest in knock-down. Others varied widely in rank for kill and knock-down. Previous work with some of the better spray mixtures has shown them to be highly repellent [**31** 196] and satisfactory in their effect on the skin of cows. Sprays that have proved satisfactory from all points of view are 3 per cent. Thanite in base oil and 3·75 per cent. or more of 20 : 1 pyrethrum concentrate with 5 per cent. D.H.S. Activator in base oil.

MATTHYSSE (J. G.). **Biology of the Cattle Biting Louse and Notes on Cattle Sucking Lice.**—*J. econ. Ent.* **37** no. 3 pp. 436–442, 4 figs., 6 refs. Menasha, Wis., 1944.

The duration of the egg stage of *Linognathus vituli*, L., and *Solenopotes capillatus*, End., observed under winter barn conditions on dairy heifers in New York in 1942–43 was 9–13 days with an average of 11, while that of *Haematopinus eurysternus*, Nitzsch, was 10–16 days with an average of 13. The oviposition rates of *H. eurysternus* and *S. capillatus* were 1–2 eggs per day, and that of *L. vituli* was one egg per day.

Damalinia (*Bovicola*) *bovis*, L., was reared off the host at constant temperature and humidity on cattle hair supplemented with dry brewers' yeast. The optimum

temperature and relative humidity appeared to be about 95°F. and 75–84 per cent. Under these conditions, the lice were reared through two gener tions over a period of two months. At 95°F., the greatest percentage of eggs hatched at 84 per cent. relative humidity, but development took longer than at lower humidities. A temperature of 100°F. was too high for populations to be maintained, and 125° was lethal within an hour. Since the normal skin temperature of heifers in the summer was found to be about 100°F. and the action of direct sunlight raised the skin temperature to over 125° in two minutes, it would appear that populations cannot be maintained throughout the year in this area, where heifers are usually infested in winter [*cf. R.A.E.*, B **32** 123]. Skin temperatures over the shoulders in winter averaged 92–93°F. Humidity, light, diet and skin condition are probably also involved in determining seasonal distribution.

It is estimated that in winter on the host the egg stage, the first, second and third instars, the pre-oviposition period and the complete cycle of *D. bovis* would occupy 8, 7, 5·5, 6, 3 and 29 days, respectively, and that the oviposition rate would be one egg per female every 35 hours. The maximum length of life recorded for a female was 42 days. The estimate of the duration of the total life-cycle was confirmed by rearing on the host. *D. bovis* normally reproduces parthenogenetically. It was maintained through two generations without males being produced or introduced. Males occur in very small numbers in natural infestations, but are most numerous in rapidly increasing populations, so that they probably have some function, though its nature has not been determined. Pairing was not observed, and females kept in constant association with males yielded only female progeny.

Wirth (W. W.). **Notes on the Occurrence of *Anopheles georgianus* King in Louisiana.**—*J. econ. Ent.* **37** no. 3 p. 446, 4 refs. Menasha, Wis., 1944.

Records are given of the finding of larvae of *Anopheles crucians georgianus*, King, in four localities in Louisiana in 1942 [*cf. R.A.E.*, B **32** 77]. They were taken only in small, acid hillside puddles of clear water in seepage areas, usually in full sun. There were generally filamentous yellow-green algae in the water, and the edges of the puddles were very grassy.

Papers noticed by Title only.

Beato Núñez (V.). **Historia de la parasitología y de la medicina tropical en Cuba, con especial referencia a los datos bibliográficos.** [History of Parasitology and tropical Medicine in Cuba, with special Reference to bibliographical Data.]—*Rev. Med. trop. Parasit.* **7** pp. 36–43, 79–80, 104–105, 123; **8** pp. 15–16, 29–30, 43, 54–56, 72–73, 83; **9** pp. 13–14, 27, 46, 72–74, 95–96; **10** pp. 23–24, 47–48, 70–71, 105–106, 136–141. Havana, 1941–44.

Caballero Descalzo (A. J.). **Historia del paludismo en Cuba (con especial referencia a los datos bibliográficos).** [History of Malaria in Cuba, with special Reference to bibliographical Data.]—*Rev. Med. trop. Parasit.* **10** pp. 15–21, 28–37, 7 pp. refs. Havana, 1944.

Roth (L. M.). **A Key to the *Anopheles* of the southeastern United States, by male Genitalia (Diptera, Culicidae).**—*Amer. Midl. Nat.* **31** no. 1 pp. 96–110, 61 figs., 8 refs. Notre Dame, Ind., 1944.

Colas-Belcour (J.). **L'oeuf et la ponte de *Taeniorhynchus* (*Coquillettidia*) *richiardii* Ficalbi.** [The Egg and Egg-batch of *Mansonia richiardii* in France.]—*Bull. Soc. Path. exot.* **36** no. 3–4 pp. 101–105, 2 pls., 1 fig., 15 refs. Paris, 1943.

MacGregor (I. M.). **A Case of accidental intestinal Myiasis** [caused by *Stomoxys calcitrans*, L.].—*Brit. med. J.* no. 4383 p. 14. London, 1945.

RENN (C. E.). **The Food Economy of *Anopheles quadrimaculatus* and *A. crucians* Larvae. Relationships of the Air-water Interface and the Surface-feeding Mechanism.**—*Symposium on Hydrobiology* pp. 329-342, 3 figs., 8 refs. Madison, Wis., Univ. Wis., 1941. [Recd. 1945.]

Details are given of observations in the United States on larvae of *Anopheles quadrimaculatus*, Say, and *A. crucians*, Wied., which showed that they feed by two distinct methods. The classical or eddy mechanism of feeding in the sub-surface layer [*R.A.E.*, B **18** 34] was less usual in natural breeding places than a method, here called interfacial, in which the floating particles approach the mouth jerkily along straight lines from all directions with approximately equal velocity, carried along by the air-water interfacial film, which itself undergoes contraction and flow caused by the feeding movements of the larva. Under experimental conditions, the type of feeding was determined by the physical properties of the medium, eddy feeding replacing interfacial feeding as surface tension decreased. It is suggested that these findings may have a bearing on research on larvicides.

COGGESHALL (L. T.). **The Relation of Hydrobiology to Malaria Control.**—*Symposium on Hydrobiology* pp. 343-354. Madison, Wis., Univ. Wis., 1941. [Recd. 1945.]

This is a discussion, based on the literature, of the ways in which Anophelines have been or might be controlled by modifying the chemical or physical characters or flora and fauna of the water in which they breed and by avoiding the formation of breeding places owing to the activities of man.

GILYARD (R. T.). **Mosquito Transmission of Venezuelan Virus Equine Encephalomyelitis in Trinidad.**—*Bull. U.S. Army med. Dep.* no. 75 pp. 96–107, 5 figs., 7 refs. Washington, D.C., 1944.

It is thought that Venezuelan equine encephalomyelitis was probably introduced into Trinidad [*R.A.E.*, B **32** 139] by infected mosquitos flying across the Gulf of Paria. P. J. Anduze stated that he had observed *Anopheles albimanus*, Wied., *A. aquasalis*, Curry, *Mansonia titillans*, Wlk., and *Aëdes taeniorhynchus*, Wied., to be consistently present in collections of adult mosquitos in epizootic swamp areas in Venezuela. *A. taeniorhynchus* had the longest flight range of any Venezuelan mosquito, and had been collected at considerable distances from breeding areas, whereas the other marsh-breeding species found in the epizootic area had a very restricted flight range. As *A. taeniorhynchus* can carry and transmit the western and eastern viruses of equine encephalomyelitis in the United States [**25** 128; **31** 203] and adults are not infrequently seen in Trinidad, it is considered probable that it can carry the Venezuelan virus also and introduced it into the Island.

Mosquito breeding is intensive in the area of Trinidad where the outbreak occurred in 1943. The principal agricultural industry is rice cultivation, the villages are crowded, and animals and man live in close proximity. Two stable-type traps [**23** 302], baited, respectively, with an infected donkey and horse, were used in an effort to determine the principal vector. Of the mosquitos caught, 90 per cent. were of the genus *Mansonia* and were identified as members of the *titillans* complex. Females of this complex trapped on an active equine case in October 1943 were shown to contain the virus of Venezuelan equine encephalomyelitis, and six females trapped on an active donkey case in the epizootic area during the night of 11th December transmitted a fatal infection to a susceptible donkey on which they were allowed to feed on 17th. The bite

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of one female of *Anopheles neomaculipalpus*, Curry, trapped on an active donkey case, produced a febrile reaction in a susceptible donkey colt, which was shown to be immune 17 days later. This mosquito is very common in Trinidad, where it breeds in pools and feeds on both man and animals, and it was frequently collected in the stable traps in moderate numbers.

It is considered probable that members of the *titillans* complex were the main vectors concerned in the Trinidad epizootic though *A. neomaculipalpus* may have been a subordinate vector. These mosquitos appeared to feed much more readily on equines than on man, whereas *Aëdes taeniorhynchus* feeds indifferently on man and animals. *A. taeniorhynchus* was not found in the swamp area where the epizootic occurred, but the view that it introduced the virus receives some support from the fact that the fatal case of encephalitis in man [**32** 139] occurred six weeks before the epizootic and some miles away from the epizootic area.

PEPPLER (H. J.). **Usefulness of Microorganisms in studying Dispersion of Flies.**—*Bull. U.S. Army med. Dep.* no. 75 pp. 121–122, 3 refs. Washington, D.C., 1944.

During an outbreak of gastro-enteritis among troops in a bivouac area, *Musca domestica*, L., which is known to carry *Salmonella enteritidis* and deposit it on food, was found to be breeding in numbers in sewage about three miles away, and was shown to be coming to the bivouac from this breeding place by the use of baker's yeast (*Saccharomyces cerevisiae*) as an indicator. All garbage at the bivouac area was first disposed of. Trapped and emerging flies at the breeding place were then heavily sprayed at dusk with a suspension prepared by dispersing 4 oz. compressed yeast in 1 U.S. gal. water and also with cultures of *Serratia marcescens* and *Pseudomonas aeruginosa* suspended in physiological saline solution. At dawn each morning, numerous random samples of flies from thoroughly cleaned traps set in the bivouac area and on the walls of kitchen and storage tents were collected in sterile test tubes and washed in sterile physiological saline solution, which was then used to inoculate agar plates and a selective acid medium for fungi. The yeast was thus recovered from 50, 33 and 15 per cent. of the samples obtained 36, 60 and 84 hours after spraying. Samples taken later did not contain it. The detection of *Serratia marcescens* was complicated by overgrowths of other bacteria on the agar plates, and results with *Pseudomonas aeruginosa*, which was found to form part of the microbial flora of the sewage pond, were not significant. *Salmonella enteritidis* was found on flies breeding in the sewage pond and on flies near the field kitchens, and sanitary measures in the breeding area and fly control in the field ended the epidemic in a few days.

The use of pigmented yeasts or pink *Torula* instead of baker's yeast would facilitate laboratory identification of the tracer agent, but they are seldom readily obtainable. White chalk, white paint and solutions of certain dyes were found by preliminary experiments to be difficult to detect after application to flies.

YOLLES (T. K.), YOLLES (S. F.) & BYRD (D. A.). **On the Occurrence of *Anopheles pessoai* in Trinidad, B.W.I.**—*Science* **100** no. 2607 pp. 547–548. Lancaster, Pa., 1944.

In and after October 1943, larvae and adults of *Anopheles pessôai*, Galvão & Lane, were found in Trinidad. This Anopheline occurs in northern South America, but had not previously been recorded in the West Indies; it was probably introduced by aeroplane. Characters distinguishing the adults of both sexes and the larvae from those of *A. albitarsis*, Arrib., are given in a table.

RUSSELL (P. F.), KNIPE (F. W.), RAMACHANDRA RAO (T.) & PUTNAM (P.). **Some Experiments on Flight Range of** *Anopheles culicifacies*.—*J. exp. Zool.* **97** no. 2 pp. 135–163, 13 figs., 15 refs. Philadelphia, Pa., 1944.

The following is based on the authors' summary and conclusions. Nine experiments on the flight-range of *Anopheles culicifacies*, Giles, were carried out in Madras between 22nd July and 28th October 1941. Mosquitos marked with coloured dust were released at a point around which 80 calf-baited traps were arranged in concentric circles with radii of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 mile. The larger circles had, respectively, two, three and four times as many traps as the smallest so that the traps were the same distance apart on each circle. Some 207,800 mosquitos were collected in the traps and in villages just beyond them and examined for evidence of coloured dust. The greatest observed flight-range was between 1·5 and 1·75 miles. Nine mosquitos flew this distance in a night and seven others in two nights. Three of the flights were against the wind.

The object of the study was to find a basis on which to fix the limits of the zone in which anti-mosquito measures are necessary for malaria control. The data obtained were analysed statistically. If the flight-ranges of the mosquitos released had been random, a similar proportion should have been taken on the periphery of each of the four zones of the experimental field. The observed dispersion never achieved this, and it must be concluded that inhibiting factors prevented a random distribution of flight-ranges. The relationship between mosquito captures (y) and distance proved to be hyperbolic with an equation of the form $y=a \div x^b$, where x is the distance in miles from the point of release, a is the number of mosquitos expected on the circle with radius of 1 mile and b is the measure of flight-inhibiting factors. The value of a is determined primarily by the number of mosquitos released. The value of b is a measure of the extent to which the flight ranges of a specific group have been inhibited. Thus the b value for males of *A. culicifacies* (1·602) was greater than that for females (0·681). Mosquitos flying with the wind were less widely dispersed than those flying across or against the wind. Mosquitos taken in nature flew greater distances than those bred in the laboratory, although the difference between the b values for the two groups was not significant.

It is pointed out that although the effect of flight-inhibiting factors has been defined for the various groups of Anophelines recaptured, it may not be maintained very far beyond the 1-mile limit; that, owing to the wide fluctuations of the observed captures, estimates based on the equations for distances within the 1-mile zone are subject to a considerable standard error; and that effective female flight-range leading to malaria transmission is dependent on the number of females coming to rest in human habitations. Adjustments must be made of density estimates based on animal-trap catches before such a figure can be obtained.

USINGER (R. L.). **Entomological Phases of the recent Dengue Epidemic in Honolulu.**—*Publ. Hlth Rep.* **59** no. 13 pp. 423–430, 12 refs. Washington, D.C., 1944.

The only mosquitos occurring in Hawaii are *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), *Aëdes aegypti*, L., and *A. albopictus*, Skuse. Because of this limited mosquito fauna and extreme isolation and rigid quarantine, mosquito-borne diseases are not frequent, but outbreaks of dengue occurred in Honolulu in 1903 and 1912 and another began in July 1943. The course of this outbreak, which reached a peak in September and diminished during the rest of the year, is described.

The systematic position and distribution of *A. aegypti* and *A. albopictus* are discussed. A survey of distribution records and comparison of material from various islands in the Pacific indicated that *A. albopictus* and *A. scutellaris*,

Wlk., have been confused under the name *albopictus* in the literature on dengue, and A. Stone confirmed this from a study of specimens in the U.S. National Museum. The specimens of *A. albopictus* were all from the Oriental region, including the Philippines and the Hawaiian Islands, while other Pacific Islands to the south and west (New Hebrides, Samoa, Tonga, Fiji and Guam) had various forms of *A. scutellaris*. Both species have been reported from New Guinea and the Philippines, and *A. albopictus* also occurs in Madagascar and the northern part of Australia. Characters distinguishing the two species are given.

A. albopictus is dominant over *A. aegypti* in Honolulu, where it breeds in ant cups, flower pots, jars, etc., and it is a severe pest throughout the lower forest area, where it breeds in tree holes and water at the bases of the leaves of plants and is found up to about 2,000 ft. It bites by day but not by night, has a short flight-range and usually oviposits at or above the water's edge, though in captivity eggs are sometimes laid on the surface of the water. All premises in Honolulu are inspected every ten days for breeding places of *Aëdes*. During the epidemic, the interior of all premises in and around a focus of several cases was sprayed with commercial fly spray, while foliage around them was sprayed with a 3 per cent. emulsion of oil containing pyrethrum extract. The *Aëdes* index varied very much from one district to another, and the number of cases of dengue was almost in inverse proportion to it but was correlated with the density of the human population. *C. fatigans*, which is not a vector of dengue, breeds in street gutter catch basins, in ground pools in air raid shelters and in irrigation water in sugar-cane fields, and was common in wells of brackish water in one area. It has been recorded at an altitude of 5,000 ft. on the Island of Hawaii, and was taken during a survey of inter-island freight and passenger planes. Its control is considered important in view of the risk of introduction of filariasis [caused by *Filaria bancrofti*] from islands in the South Pacific.

Wood (S. F.). **Observations on Vectors of Chagas' Disease in the United States. I. California.**—*Bull. S. Calif. Acad. Sci.* **41** pt. 2 pp. 61–69, 22 refs. Los Angeles, Calif., 1942. (With a Summary in Spanish.) [Recd. 1945.]

This is the first part of a series of which the second has already been noticed [*R.A.E.*, B **32** 57]. It includes a review of the papers in which *Trypanosoma cruzi* had been recorded in Triatomids in California, Arizona, Texas and New Mexico ; a list of the species examined for infection in these States and (with negative results) in Utah, showing the numbers of each and the numbers and percentages infected ; new locality records for infection in *Triatoma protracta*, Uhl., in California ; lists of numerous Californian mammals in which infection was not found by blood examination or xenodiagnosis ; and a discussion of the effects of the bites of Triatomids on man, which are severe in some individuals and imperceptible in others. In California, *Trypanosoma cruzi* has been found only in *Triatoma protracta*, in a single example of *Neotoma fuscipes macrotis* [**23** 41] and, possibly, in a bat.

Wood (S. F.). **Additional Notes on the Persistence of *Trypanosoma cruzi* in dead Insect Vectors.**—*Bull. S. Calif. Acad. Sci.* **42** pt. 3 pp. 115–127, 6 refs. Los Angeles, Calif., 1944.

Details are given of experiments on the persistence of various strains of *Trypanosoma cruzi* in a viable state in nymphs of *Triatoma* spp. after they had died naturally in the laboratory [*cf. R.A.E.*, B **31** 179] or had been killed or immobilised by exposure to hydrocyanic acid gas. Some treated with the gas survived for many days and could, if stimulated, move legs and antennae, but could not crawl. The longest periods for detection of living stages of the

trypanosome after natural death of the bugs were 41 days in *T. protracta*, Uhl., 3 days in *T. protracta woodi*, Usinger, and 24 days in *T. rubida*, Uhl., and the longest periods after death or immobilisation by cyanide were 127 days in *T. protracta*, 122 days in *T. rubida* and 16 days in *T. longipes*, Barber. The author considers that the persistence of *Trypanosoma cruzi* in dead bugs is of importance in maintaining a large rodent reservoir of infection, since rodents acquire infection by feeding on them [**31** 180]. They would be particularly likely to notice dying bugs that still moved their antennae or legs.

Some of the bugs in all the cultures used for these experiments were found to be infested by *Ereynetes concolor*, Hald. This mite occurred most often on *Triatoma rubida* from nests of wood rats [*Neotoma*] in Arizona. No trypanosomes were found in mites from infected bugs.

Monro (H. A. U.), Briand (L. J.), Delisle (R.) & Smith (C. C.). **Some Experiments with the Pyrethrum Aerosol under Canadian Conditions.**—*74th Rep. ent. Soc. Ont. 1943* pp. 42–45, 3 refs. Toronto, 1944.

The results are given of experiments in Canada in 1943 on the control of insects with an aerosol consisting of 5 per cent. pyrethrum extract containing 20 per cent. pyrethrins, 2 per cent. sesame oil and 93 per cent. dichlordifluoromethane. It was usually dispersed from a five-pound storage cylinder through a steel capillary tube five inches long with an internal diameter of 0·017 inches [*cf. R.A.E.*, B **32** 99], soldered on an oil-burner nozzle. The nozzle was intended only to hold the tube, but its wire filter helped to prevent clogging. Hypodermic needles of various internal diameters and lengths mounted directly on to the cylinders were also used with success.

Simuliids readily entered a sail silk tent at an experiment station in New Brunswick when the weather was fair and warm. At 75°F., the aerosol applied with the capillary tube at 0·05 oz. per 1,000 cu. ft. caused 50 per cent. of the Simuliids to drop and at 0·1 oz. it caused them all to drop in 1-3 minutes. All those that dropped at either rate of application died within 8 hours. Up to 0·25 oz. was required at about 60°F. In experiments in Quebec, exposure to 0·1 oz. per 1,000 cu. ft. for one hour at 70-80°F. caused complete mortality of all flies tested, which comprised Simuliids, Tabanids, Muscids, Sarcophagids and Calliphorids. Aerosols are generally unsuitable for use against *Blattella germanica*, L., because many of the cockroaches are driven away by the stimulating action of the pyrethrum and eggs are not killed. However, in dining cars on trains, where the use of powders might be dangerous, the active population of *B. germanica* was reduced by 90–95 per cent. at temperatures above 60°F. by one application of the aerosol at the rate of 2 oz. per 1,000 cu. ft., using the capillary tube. The whole car was treated after the kitchen and pantry at the first application to kill escaping cockroaches or those free in the body of the car. Only the kitchen and pantry received the subsequent applications, of which as many as seven were made at intervals of 1–4 weeks. This treatment reduced the population to what appeared to be an irreducible minimum. When using the aerosol at this dosage, it was advisable to wear a respirator equipped with a filter used against particulate suspensions.

Gregson (J. D.). **The Influence of Fertility on the Feeding Rate of the Female of the Wood Tick, *Dermacentor andersoni* Stiles.**—*74th Rep. ent. Soc. Ont. 1943* pp. 46–47, 4 figs., 2 refs. Toronto, 1944.

Tick paralysis of livestock and man caused by the feeding of one female or more of *Dermacentor andersoni*, Stiles [*R.A.E.*, B **32** 80] is almost always associated with rapid engorgement [**25** 178]. Females that take more than seven days to engorge seldom cause paralysis. In experiments carried out at Kamloops, British Columbia, in an attempt to find why some individuals engorge more

rapidly than others, the ticks were found to feed very reluctantly towards autumn [**25** 178 ; *cf.* also **30** 68], and fluctuations in temperature and exposure to ultra-violet light increased their appetites. When four groups of ticks, two consisting of 4–5 females and the same number of males and two consisting of 6–7 females only, were put to feed on a sheep on 1st October, all the paired females had become engorged and detached at the end of a week while the unmated ticks were all attached and only about half engorged ; this indicated that the presence of males stimulates the rate of feeding of the females. However, when a pair of ticks was placed on each of 50 day-old lambs in April 1940, none of the females fed rapidly.

Brown (J. H.). **The Spotted Fever and other Albertan Ticks.**—*Canad. J. Res.* (D) **22** no. 2 pp. 36–51, 1 pl., 2 maps, 30 refs. Ottawa, 1944.

The results are given of a survey of ticks and tick-borne diseases in southern Alberta begun in 1938 [*cf. R.A.E.*, B **28** 143] and concerned principally with *Dermacentor andersoni*, Stiles, which is present in large numbers throughout the greater part of the region. It transmits Rocky Mountain spotted fever and tularaemia, both of which occur there in man [**32** 9–11, etc.], and causes tick paralysis [**25** 178], of which one definite case and two suspected cases in man and two cases in sheep have occurred in Alberta since 1938. The adults are abundant from April to August and their hosts include coyotes, rabbits and wild ungulates as well as horses, cattle and sheep [*cf.* **28** 143]. The females take about 12 days to engorge and are fertilised during engorgement, after which they drop to the ground to oviposit. The incubation period is 17–51 days. The larvae feed for 3–8 days on small rodents, fall to the ground and moult into nymphs, which usually hibernate. In spring, they engorge for 7–10 days on another rodent and moult on the ground. The adults may find a host at once or remain quiescent for the summer and hibernate. If they again fail to find a host they can repeat the hibernation once or more than once.

Data on the areas of southern Alberta found to be infested with this tick in each of the years 1938 to 1942 are given in considerable detail. During this time, 58,534 ticks were collected by dragging and 3,851 from hosts in 412 separate collections, of which two were positive for spotted fever and 16 for tularaemia. The abundance of *D. andersoni* varies with the numbers of sheep and cattle in the district. Observations made during 1938 indicate that it is active at night. The ticks did not very readily transfer from vegetation to drags in very hot or cold weather, but were taken during both rain and snow storms so long as the drag remained dry. They were collected in very varied surroundings, but principally in small valleys well covered with vegetation and having numerous cattle paths, and an eastern or north-eastern aspect. Most were found on the western and southern slopes. There are signs that *D. andersoni* is becoming more common in old areas of infestation and establishing itself in new ones. The reasons for the apparent great increase in its numbers are discussed. It is suggested that the suppression of prairie fires, which usually occurred in May when ticks are most active, and also the introduction of large flocks of sheep and, in newly settled districts, of other domestic animals, may be involved. The literature on the establishment of the importance of *D. andersoni* as a vector of Rocky Mountain spotted fever and tularaemia in man and the cause of tick paralysis of man, sheep and cattle is reviewed. No cases of tick paralysis in cattle are known to have occurred in Alberta. It is stated that a new disease of man, believed to be transmitted by *D. andersoni* was found in the Eastend district of Saskatchewan during the survey, but no further details are given about it.

Nine other species of ticks have been reported from Alberta. They are *D. albipictus*, Pack., which is practically confined to the mountainous and northern parts of the Province, where it infests moose and other ungulates [*cf.* **31** 132],

Haemaphysalis leporis-palustris, Pack., which is fairly common on hares, *H. cinnabarina*, Koch, which was taken once in southern Alberta in 1942, *Otobius* (*Ornithodoros*) *megnini*, Dugès, which has been found occasionally in southern Alberta, *Otobius lagophilus*, Cooley & Kohls, taken on a cat in 1941, and four species of *Ixodes*. Notes are given from the literature on the hosts and distribution of some of these ticks and their relation, if any, to disease. *H. leporis-palustris* has been recorded as a vector of tularaemia in nature and *H. cinnabarina* as probably transmitting this disease to birds [**20** 106].

Culbertson (J. T.). **Medical Parasitology.**—9×6 ins., xv+285 pp., 21 pls., 16 figs., 33 refs. New York, N.Y., Columbia Univ. Press; London, H. Milford, 1942. Price 28*s*. [Recd. 1945.]

This monograph, which is intended for the use of medical students and practitioners, deals primarily with the epidemiology, pathology, diagnosis, treatment and prophylaxis of the diseases caused by the animal parasites of man. General notes are also included on natural resistance and acquired immunity. Insects and the Arachnida, Crustacea and Myriapoda are the subjects of two special chapters. The one on insects contains a key to differentiate the adults of the seven Orders of medical significance (Anoplura, Hemiptera, Diptera, Siphonaptera, Hymenoptera, Lepidoptera and Coleoptera) and brief notes on the principal groups and species of importance to health in each, showing the injuries they cause or the diseases they transmit. In some cases, there is very brief indication of the usual method of control. In the other chapter, a key is given to the seven superfamilies of Acarina of medical significance, the importance of the principal species of each is outlined, and very brief notes are also given on Linguatulids, *Latrodectes mactans*, F., scorpions, centipedes and certain Crustacea that carry human parasites.

Fiasson (R.). **Contribution à l'étude des arthropodes vulnérants du Moyen-Congo.**—*Rev. Sci. méd. Afr. franç. libre* **2** no. 3 pp. 257–282, 1 col. pl., 2 figs., 17 refs. Brazzaville, 1943.

Records are given of ticks infesting animals, mites and lice infesting animals and birds, and fleas infesting man and animals in French Equatorial Africa, principally the Middle Congo, and of various Diptera, chiefly Tabanids and *Glossina* spp., taken there. *Sarcoptes* was widespread on man, sheep and goats in the region of Komono, where over 20 per cent. of the inhabitants of some villages were infested; it is thought that the form concerned on all hosts, including man, is *S. caprae*, Fürst. The commonest species of *Glossina* was *G. palpalis*, R.-D. Trypanosomes were found developing in 26 out of 235 dissected in the region of Komono, a figure which seems out of proportion with the low incidence of sleeping sickness, but none was found in the salivary glands. Numerous attempts to infect guinea-pigs failed. It is concluded from observations made that the trypanosome was not *Trypanosoma gambiense* and was probably *T. vivax*. *G. fusca*, Wlk., was taken at several places in the savannah as well as the forest. The other Diptera recorded include *Anopheles gambiae*, Giles (*costalis*, auct.), *A. funestus*, Giles, and *Aëdes aegypti*, L. (*argenteus*, Poir.). *Cimex hemipterus*, F. (*rotundatus*, Sign.) was common in native huts.

Edney (E. B.). **Laboratory Studies on the Bionomics of the Rat Fleas,** *Xenopsylla brasiliensis*, **Baker, and** *X. cheopis*, **Roths. I. Certain Effects of Light, Temperature and Humidity on the Rate of Development and on Adult Longevity.**—*Bull. ent. Res.* **35** pt. 4 pp. 399–416, 2 figs., 22 refs. London, 1945.

The following is mainly based on the author's summary of the results of experiments carried out under controlled conditions in Uganda between

December 1941 and June 1944. An investigation was made of the effect of light on the duration of the adult and immature stages of *Xenopsylla brasiliensis*, Baker, and *X. cheopis*, Roths., and the effect of psychrometric conditions during the immature stages on the length of adult life. In no experiment was a significant difference found between the two species, and figures for *X. brasiliensis* only are shown in the tables, except in the case of the first experiment. Light slightly reduced the length of life of unfed, wild-caught adults and of unfed laboratory-bred adults, and considerably reduced the duration of all immature stages. It is suggested that this is due to radiant heat. If fleas were anaesthetised while being removed from their hosts, the mean length of life was significantly reduced. It was confirmed that wild-caught females lived longer than males [*R.A.E.*, B **24** 18], that the cocoon stage of females is shorter than that of males under all conditions used [*cf. loc. cit.*], and that the length of life of newly emerged adults kept without food shows no difference between males and females [**20** 181; **24** 17], probably because, unlike the fed adults, they do not differ in size.

Eggs failed to develop at 24°C. [75·2°F.] if the saturation deficiency was 10 mm. mercury or more, but variations in saturation deficiency below this level had little or no effect on the duration of the egg stage. At 80 per cent. relative humidity, all the immature stages were shorter at 35°C. [95°F.] than at 24°C. When adults were kept in the same conditions, those resulting from immature stages kept at the higher temperature lived for the shorter time. At 24°C., the larval period increased from 12·4 to 25·1 days as the saturation deficiency increased from 2·3 to 8·8 mm., but this range of saturation deficiency had no effect upon the duration of the cocoon stage. Adult life was significantly shorter if the immature stages had been passed at a saturation deficiency of 2·3 or 8·8 mm. than if they had been passed at one of 4·5 or 6·7. The length of life of adults fell steadily from 20·1 to 16·8 days as the saturation deficiency in which the cocoons were kept rose from 2·3 to 8·8 mm. As pupae do not lose water [*cf.* **21** 199], this must have been due to loss in the pre-pupal stage. Saturation deficiency during the pre-pupal stage was shown to bear a linear relationship to length of adult life. The results obtained by previous workers are discussed in the light of the present work, and an explanation is suggested for certain discrepancies.

Campbell (G. A.) & West (T. F.). **DDT, the new Insecticide. A general Survey and some possible Paint Applications.**—*J. Oil Col. Chem. Ass.* **27** no. 294 pp. 241–262, 20 figs., 3 refs. Slough, 1944.

In the first part of this paper, which deals with the research that resulted in the discovery of the insecticidal properties of αα-dichlor-diphenyl-βββ-trichlor-ethane [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane], commonly known as DDT, the authors give details of the original investigations on moth-proofing agents, and show the types of molecular structure that were found to be associated with toxicity to clothes moths and an affinity for wool fibre. They then describe later studies in which a wider range of substances was investigated on other insects, comparing formulae of effective and ineffective synthetic organic stomach poisons, and a biological analysis of the process of contact poisoning, which suggested that a contact insecticide that does not act through the tracheal system must be lipoid-soluble. This led to the preparation of DDT, which showed an insecticidal effect not previously observed in a synthetic substance. The molecular structures of several compounds related to DDT are shown, with information on their effectiveness as contact insecticides for house-flies [*Musca domestica*, L.], and the method of action of DDT is discussed. It is considered that the DDT molecule provides an example of internal synergism in which the lipoid-solubility of the chloroform residue increases the effectiveness of the *p*, *p*′-dichlor-diphenyl condensate.

In the second part are described experiments carried out in 1944 in view of the long duration of effectiveness against flies of spray deposits of DDT on walls [*R.A.E.*, B **32** 175; *cf.* also **32** 197–198, 200–202] and designed to ascertain whether it could be incorporated in a paint or other more permanent surface coating. In small-scale tests in which house-flies were allowed to emerge in cages treated with dry distemper, oil-bound water paint, white lead oil paint or synthetic varnish enamel, each alone or with 5 per cent. DDT incorporated by grinding, numbers of flies died in both distempered cages, probably because they became coated with powder, and the oil paint and the synthetic enamel containing DDT gave no control, but the oil-bound water paint containing DDT was effective; it had lost none of its effectiveness after two months and little after six. House-flies that were released in small rooms treated with oil-bound water paint alone or containing only 0·5 per cent. DDT showed 3 and 90 per cent. mortality, respectively, in 48 hours, and the poison was still effective a fortnight later; no evidence of repellent action was obtained. Changes in relative humidity had no apparent effect on toxicity, but lowering the temperature from about 70 to 60° F. resulted in lower mortalities in the room containing the insecticide, and not in the other. Experiments with flies 1–6 days old showed that the older flies were affected more quickly than younger ones, and three months after application the percentage kill of six-day-old flies in 24 hours was still 99 whereas that of two-day-old flies was only 66 instead of 82. In a large-scale test in which the dining room and kitchen of a heavily infested factory canteen were treated with oil-bound water paint containing 1 per cent. DDT, the numbers of flies decreased considerably during the first day, whereas the bakery, which was left untreated, was still heavily infested. Large numbers were dead next morning and although reinfestation continued most of the flies that entered came into contact with the paint and eventually died; the slow action of the DDT made it necessary to continue with a certain amount of spraying. Preliminary tests showed that DDT incorporated in a film of coumarone resin was extremely effective; there appeared to be microcrystals of DDT on the surface of the film, and it was not so effective when freshly dried as after 24 hours. Coumarone resin increases the solubility of DDT in paraffinic solvents in which it is normally only soluble to the extent of 5–10 per cent.; if DDT is dissolved in its own weight of coumarone resin by melting the two together, this can be dissolved in white spirit to give a solution containing equal parts of DDT, resin and white spirit or an even higher proportion of DDT. There is evidence that the coumarone resin increases the insecticidal activity of DDT and that its rate of penetration is accelerated when it is in the resin-spirit solution so that the minimum concentration necessary to kill flies is attained with great speed and certainty. DDT was found to be particularly effective when fabrics were impregnated with it and quite effective in wax floor polishes, though its action was slower in the second case, probably owing to the tendency of the waxes to retain it.

Wasicky (R.) & Unti (O.). **Dicloro-difenil-trichloro-etano (DDT) no combate às larvas de culicídeos.** [DDT for the Control of Mosquito Larvae.]—*Arq. Hig. Saúde publ.* **9** no. 21 pp. 87–102. São Paulo, 1944.

An account is given of experiments in São Paulo, on the use against mosquito larvae of 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane, otherwise known as dichlor-diphenyl-trichlor-ethane, pentachlor-diphenyl-ethane or DDT. When DDT was dissolved in an organic solvent to make stock solutions that were then diluted with water and applied in the laboratory to the water in glass tanks containing larvae of *Culex* sp., *C. fatigans*, Wied. (*quinquefasciatus*, auct.), *Anopheles strodei*, Root, and *A. albitarsis*, Arrib., together with plants, other water insects and fish from natural breeding places, all the larvae were killed in periods that ranged from less than five minutes for a DDT concentration of 1 : 1,000 in the tank up to 4–7 hours for one of 1 : 25,000,000, 24–36 hours for

one of 1 : 50,000,000, and over 36 hours for one of 1 : 60,000,000. Four of the tanks, in which the concentrations ranged progressively from 1 : 10,000,000 to 1 : 20,000,000 and the initial periods for mortality from 30–60 minutes to 2–5 hours, were left untouched for over two months and larvae were added weekly. The period required for complete mortality increased very little during this time, and the vegetation was not affected.

When eggs of *A. strodei*, *A. albitarsis* and *C. fatigans* were placed in vessels of water containing DDT at concentrations of from 1 : 10,000,000 to 1 : 50,000,000 no larvae were observed during the following 15 days, whereas they were numerous after 2–3 days in the untreated controls. Microscopic examination of the eggs showed that they had hatched, so that the larvae must have died immediately after leaving the shells. When two vessels of water containing DDT at concentrations of 1 : 25,000,000 and 1 : 15,000,000 were kept in the open from December 1943 to March 1944, together with two control vessels, females of *Culex* sp. and *C. fatigans* oviposited indifferently in all four vessels, but no larvae were observed in those treated with DDT, though they were numerous in the others. Examination again showed that the eggs in the treated water had hatched.

Field experiments were carried out in natural breeding places. In May 1944, a pool, with an average depth of 6½ ft., in which larvae of several species of *Anopheles* and *Culex* were numerous, was treated with the stock solution of DDT diluted with water, so that the concentration in the pool was 1 : 25,000,000 ; five hours later, no living larvae could be found, though pupae of all species were unaffected. During the following 20 days, no larvae were observed in the pool. Two small pools rich in vegetation and containing larvae of *A. strodei* and *A. albitarsis* were dusted with powdered cork on which DDT had been adsorbed at the rate of 1 : 1,000, so that the rate of application was about 25 mg. DDT per sq. metre [1·196 sq. yd.]. Very few larvae were alive four hours later, and none after 19 hours, though the pupae were still living. Other tests were carried out in the wet season (February-March) of 1944. Complete control of larvae of *Culex* was given in 24 hours, though not in six, by dusting a small pool with DDT adsorbed on powdered cork (1 : 1,000), at a rate equivalent to 12·5 mg. DDT. per sq. metre, and in six hours by dusting another with DDT adsorbed on plant ash (1 : 10,000) at a rate of application equivalent to about 22 mg. DDT per sq. metre. Other small breeding places were successfully treated with the undiluted stock solution to give a concentration of 1 : 25,000,000. Complete control of *Culex* larvae was also given in five hours in December 1943 in a tank of water treated with the solution to give a concentration of 1 : 20,000,000, and the water remained free from larvae for 35 days, in spite of dilution by rainwater and oviposition by mosquitos. The tank was cleaned and refilled in February and breeding then proceeded normally. In March, it was again treated with DDT at a concentration of 1 : 40,000,000, and complete control of the larvae was obtained in 13 hours.

In laboratory tests, the results of which are shown in tables, DDT proved harmless to dogs, cats, rats, mice, fowls and pigeons when injected or administered in food, and to frogs and fish when added to the water in which they bred, in concentrations suitable for larvicidal purposes. It also proved harmless when applied in various ways to the skin of guineapigs and dogs, the forearm of human volunteers and the conjunctiva of rabbits.

In a brief discussion of the ways in which DDT can be used against mosquito larvae, it is considered that it is best applied in the stock solution to give a concentration of 1 : 25,000,000 in the water. The solution should contain 4 per cent. DDT and should be mixed with water before being sprayed over large areas, though this is unnecessary for small ones. The amount of solution applied should be doubled if it is desired to keep the water free from larvae for a considerable period or if it is likely to be diluted by rain. It can be applied to streams by means of a drip apparatus, in the same way as petroleum oils. The

adsorbed dusts are applied in the same way as Paris green and do not sink. They are somewhat slower in action than solutions.

Knight (K. L.) & Farner (D. S.). **A Correction in Anopheline Nomenclature (Diptera : Culicidae).**—*Proc. ent. Soc. Wash.* **46** no. 5 pp. 132–133. Washington, D.C., 1944.

The authors conclude from a study of the literature and of material collected over a period of more than a year in the coastal areas of the Islands of Efate and Espiritu Santo and on one occasion on Mallicolo Island that the subspecies or variety of *Anopheles punctulatus*, Dön., known as *moluccensis*, Sw. & Sw., in the New Hebrides [*cf. R.A.E.*, B **30** 186], and in which the proboscis, excluding the labella, is entirely dark, should be designated *A. punctulatus farauti*, Lav. It was the only form seen there. It is not possible to say whether *A. p. moluccensis* is a synonym of *farauti*, but it is anticipated that this will prove to be the case. Examination of several hundred specimens from the Solomon Islands and eastern New Guinea supports the theory; but de Rook [**12** 178] indicates that a considerable variation in the colour of the proboscis exists in western New Guinea, where most of the females determined by him as *moluccensis* have a ventral pale area on the apical quarter of the proboscis.

Belkin (J. N.) & Schlosser (R. J.). **A new Species of *Anopheles* from the Solomon Islands.**—*J. Wash. Acad. Sci.* **34** no. 8 pp. 268-273, 11 figs. Menasha, Wis., 1944.

Keys are given to the adult females and larvae of the Anophelines found in a survey of the Lunga district of Guadalcanal. They comprise a species of *Bironella*, possibly *B. walchi*, Socsilo, *Anopheles punctulatus punctulatus*, Dön., *A. p. farauti*, Lav. [*cf.* preceding abstract], and a new species, *A. lungae*, of which the adults of both sexes and larva are described. *A. lungae* prefers shaded breeding places, and the larvae are usually found in the jungle, along margins of streams, in swamps, rock holes, etc. During the rainy season they are flushed out into the coconut groves on the coastal strip and breeding takes place there. Adults are usually found resting in partial shade on tree trunks in the jungle and occasionally under logs, or in boxes, etc. Males and unfed, fed and gravid females occur together. Preliminary observations indicated that the females feed mainly on birds ; they represented less than 2 per cent. of the Anophelines that attempted to attack man in the jungle, and *A. lungae* also represented less than 2 per cent. of the Anophelines taken in routine night catches in the Lunga district. *A. p. punctulatus* was never found to attack man on Guadalcanal.

Stone (A.). **Some Relationships of *Anopheles lungae* Belkin and Schlosser (Diptera : Culicidae).**—*J. Wash. Acad. Sci.* **34** no. 8 p. 273. Menasha, Wis., 1944.

Morphological characters are given that separate the adults and larvae of *Anopheles longirostris*, Brug, *A. tessellatus*, Theo., and *A. lungae*, Belkin & Schlosser [see preceding abstract] from those of related species, and others that separate females of *A. lungae* from those of *A. longirostris* and *A. tessellatus*, and larvae of *A. lungae* from those of *A. tessellatus*. The ranges of distribution of these three closely allied species have not yet been found to overlap. *A. tessellatus* occurs from India to Hong Kong, in the Netherlands Indies and the Philippines. There are a few records from the Moluccas and one doubtful one from western New Guinea. *A. longirostris* has been taken in New Ireland and various places in New Guinea. *A. lungae* has been found only in the Solomon Islands.

Baxter (C. P.) & Zetek (J.). **The *Anopheles* of Panama with special Reference to Hand Lens Identification and Notes on collecting and Care of Specimens.**—*Amer. J. trop. Med.* **24** no. 2 pp. 105–115, 6 pls., 2 figs., 17 refs. Baltimore, Md., 1944.

Descriptions are given of equipment and methods for collecting and transporting adults and immature stages of mosquitos, for handling specimens and for studying them in the field with only a hand lens available. The second part of the paper consists of a list of the Anophelines of Panama (*Chagasia bathanus*, Dyar, and 17 species of *Anopheles*), with their principal synonyms if any and very brief notes on adult morphology. Diagrams of the hind legs, palps and wings of these species are included, and their seasonal and regional distribution in Panama, adult habits and prevalence, and larval habitats are shown in tables.

Hudson (E. H.). **The Role of the Reservoir Host in tropical Disease.**—*Amer. J. trop. Med.* **24** no. 2 pp. 125–130. Baltimore, Md., 1944.

This paper includes lists compiled from standard text-books of the mammals or birds that serve as reservoir hosts of various helminths, protozoa (including spirochaetes), bacteria (including moulds) and viruses (including rickettsiae) that cause diseases of man, showing the Arthropod vector or vectors or other agent or method of transmission of each. There is also a list of a few insects, chiefly flies, that occasionally attack man, showing their normal hosts.

Reeves (W. C.) & Hammon (W. McD.). **Feeding Habits of the proven and possible Mosquito Vectors of Western Equine and St. Louis Encephalitis in the Yakima Valley, Washington.**—*Amer. J. trop. Med.* **24** no. 2 pp. 131–134, 9 refs. Baltimore, Md., 1944.

In a survey of the mosquito vectors of encephalitis made in the Yakima Valley, Washington, during 1942, the viruses of both western equine and St. Louis encephalitis were frequently isolated from *Culex tarsalis*, Coq. [*cf. R.A.E.*, B **32** 129, etc.]. *C. pipiens*, L., was also found infected once with each virus, and the western equine virus was isolated once each from *Theobaldia* (*Culiseta*)* *inornata*, Will., and *Anopheles maculipennis freeborni*, Aitken. No infection was found in large numbers of *Aëdes*. During the survey, 788 blood smears for precipitin tests were made from engorged females of two species of *Culex*, three of *Aëdes*, two of *Theobaldia* (*Culiseta*) and two of *Anopheles* collected in domestic habitats and traps and including the four species in which virus had been found. The results of the tests, which are given in a table, showed that *Culex tarsalis*, the species best fitting the epidemiological picture as a vector in this district [**29** 194–195; **32** 129], fed frequently on poultry and also attacked most of the common domestic animals and man [*cf.* **31** 73]. The feeding habits of this species alone might account for the incidence of encephalitis antibodies that has been demonstrated in domestic animals and man in the Yakima Valley. Most of the other species had fed almost exclusively on mammalian blood, except *C. pipiens*, 75·5 per cent. of which had fed on poultry. This species, which was much less common than *C. tarsalis*, probably plays an important part in the transmission of the St. Louis virus [**30** 161–162] in areas where it occurs in large numbers. Large domestic mammals are probably not important sources of infection. The results of the precipitin tests, the repeated isolation of virus from *C. tarsalis* and the finding of antibodies in fowls and other poultry give strong support to the theory that they are the important reservoir of infection in the Yakima Valley. Hand collections of mosquitos made on horse, cow and man showed that many species feed on these hosts. *C. tarsalis* was included in all collections, but it was not the most commonly collected species.

* The authors adopt the name *Culiseta* for *Theobaldia*, Neveu-Lemaire, because of the prior use of *Theobaldia* by Fischer [for the Molluscan genus *Theobaldius*, Nevill].—*Ed.*

Packchanian (A. A.). **Malaria thick Films contaminated with Excretions of Flies containing Flagellates** (*Herpetomonas*).—*Amer. J. trop. Med.* **24** no. 2 pp. 141–143, 1 fig., 5 refs. Baltimore, Md., 1944.

The following is substantially the author's summary. Two malaria thick films, one from Alabama and the other from Mississippi, were found to be contaminated with flagellates (*Herpetomonas* sp.), which had apparently been deposited on the smears by insects. Adults of *Musca domestica*, L., reared free of parasites and experimentally infected with a culture of *Herpetomonas muscae-domesticae* were allowed to feed on freshly made thick blood film, which became contaminated with *Herpetomonas* by their excreta. It is concluded that it is important to safeguard newly made blood smears from house-flies and other insects in order to avoid any possible confusion in diagnosis or the destruction of the smears.

McLintock (J.). **The Mosquitoes of the Greater Winnipeg Area.**—*Canad. Ent.* **76** no. 5 pp. 89–104, 3 graphs, 18 refs. Guelph, Ont., 1944.

A brief account is given of the topography, vegetation and climate of the Greater Winnipeg district, a roughly circular, poorly drained, level area, one hundred square miles in extent, with the City of Winnipeg in its centre. A mosquito survey of the district was carried out in 1938–40. The methods used for collecting, preserving and rearing larvae are described. A few adults were also taken while feeding on man. The 6,070 mosquitos identified comprised 13 species of *Aëdes*, three of *Culex*, two of *Theobaldia*, *Mansonia* (*Taeniorhynchus*) *perturbans*, Wlk., and *Anopheles maculipennis*, Mg., and *A. punctipennis*, Say. Brief notes are given on each, dealing with such points as morphology, breeding places, adult habits, seasonal distribution and abundance. The relative importance of the various species as pests is also indicated. The three principal ones were *Aëdes vexans*, Mg., *A. dorsalis*, Mg., and *Culex territans*, Wlk.

Murray (W. C.) & Knutson (H.). **Airplane Dusting with Paris Green for Control of** *Anopheles quadrimaculatus* **Say in water-chestnut covered Areas of the Potomac River during 1943.**—*Publ. Hlth Rep.* **59** no. 18 pp. 573–583, 2 pls., 3 figs. Washington, D.C., 1944.

The following is mainly based on the authors' summary. *Anopheles quadrimaculatus*, Say, the principal vector of malaria in the eastern United States, breeds prolifically in areas of the Potomac River covered with water chestnut (*Trapa natans*). Because of the close proximity of six military establishments to these areas, measures for the control of *A. quadrimaculatus* were carried out in 1942 and 1943. In the latter year, Paris green dust diluted with soapstone (1 : 4 by volume) was applied weekly by aircraft throughout the breeding season (4th July to 19th September). The largest area dusted at one time was 3,764 acres, and in all 40,277 lb. Paris green was used on 32,536 acres. The work is described and the cost per acre per application is given. The results of weekly inspections of more than 100 larval and adult index stations situated both inside and outside the controlled area are discussed. They indicated a mean control of 96·93 per cent. in protected areas based on counts of adult females.

Huffaker (C. B.). **The Temperature Relations of the immature Stages of the Malarial Mosquito,** *Anopheles quadrimaculatus* **Say, with a Comparison of the developmental Power of constant and variable Temperatures in Insect Metabolism.**—*Ann. ent. Soc. Amer.* **37** no. 1 pp. 1–27, 2 figs., 44 refs. Columbus, Ohio, 1944.

The experiments with *Anopheles quadrimaculatus*, Say, described in this paper confirm the value of a catenary curve developed by E. Janisch for expressing the relation of temperature to the duration of development of insects. The formula of this curve, which is derived from two simple exponential functions, one representing an accelerative and the other an inhibitive effect of

increased temperature, is $t=(m/2)(a^T+a^{-T})$, where t is time, m is developmental time at the empirically determined optimum, a is an empirically established constant that determines the slope of the curve, and T is the temperature in degrees Centigrade above or below the optimum. The reciprocal of the curve, plotting velocity of reaction against temperature, has the characteristic S-shape of the biological curve. In the case of *A. quadrimaculatus*, the values of a were 1·130 for the egg stage, 1·155, 1·145, 1·155 and 1·155 for the successive larval instars, 1·145 for the pupal stage, and 1·150 for the period from eclosion to emergence.

Most of the following is taken from the author's summary. The reaction of development of *A. quadrimaculatus* has the same general form for the total period of development as for any component stage. There is, however, a significant shift in the optimum temperature from about 33·3 to 30·3°C. [91·94 to 86·54°F.] as development progresses from the embryonic to the fourth-instar larval and pupal stages. The time-temperature relation in the development of this species conforms remarkably well to the catenary formula. The optimum is about 31°C. [87·8°F.] and the time required to complete development from newly-hatched larvae to adults may vary from as much as 1,572 hours at 12·1°C. [53·78°F.] to about 176 hours at the optimum. The shortest times required to complete the egg stage, the four larval instars and the pupal stage are 33, 30, 26, 30, 55 and 35 hours, respectively. The threshold of development is about 7°C. [44·6°F.]. The lowest generally lethal high temperature is about 35°C. [95°F.], and the highest generally lethal low temperature is about 11°C. [51·8°F.]. High temperatures have an accumulative injurious effect; a pupa, pre-reared at about 35°C. is very likely to die at that temperature, whereas one pre-reared at a lower temperature and then moved to 35°C. may give rise to an adult. The concept that death at high temperatures is associated with coagulation of protoplasm seems to be untenable. Observations on the general symptoms of approaching death at high temperatures suggest that such death may be similar to starvation at lower temperatures. It seems possible that, at barely lethal high temperatures, nutritive substances are oxidised so rapidly that the supply cannot keep pace with requirement and no net increase in mass or necessary developmental change can occur. Digestion, diffusion, transportation in the blood stream or the removal of waste products of metabolism may be partly limiting.

The metabolic power of variable temperatures is generally greater than that of constant temperatures, this difference being probably attributable to an inherent inability of the insect to maintain the initial rate of metabolism at high temperatures. The speed of accumulating thermal units or the specific source of the thermal energy, is not the explanation. The degree of acceleration of variable temperatures is greatly affected by the exact nature of the variation. Exposures to low temperatures of 17°C. [62·6°F.] or slightly lower are far more powerful in promoting an increased metabolic rate than are exposures to higher low temperatures. The basic explanation is probably that different important phases of metabolism respond to temperature changes differentially. Information put forward in this paper should be of value in determining the intervals between applications of larvicide in anti-malaria operations, and it should also make it easier to determine the temperature at which purely physiological and medical experiments with this mosquito should be carried out.

De Bach (P.). **Environmental Contamination by an Insect Parasite and the Effect on Host Selection.**—*Ann. ent. Soc. Amer.* **37** no. 1 pp. 70–74, 6 refs. Columbus, Ohio, 1944.

It was found that when pupae of *Musca domestica*, L., were exposed in tins containing barley grains to parasitism by *Mormoniella vitripennis*, Wlk., the

proportion of parasitism steadily decreased in successive experiments. In view of Salt's finding that females of *Trichogramma* so contaminate the eggs of their host by walking over them that they may not be acceptable to other females [*R.A.E.*, A **25** 405], it was thought that *Mormoniella* might be contaminating the barley grains in the same way so as eventually to inhibit oviposition. In experiments in which 40 adults of *Mormoniella* searched for 80 puparia of *Musca* through 2 U.S. quarts of barley, the percentages of puparia parasitised were 32·5 and 38·75 in new barley in a clean and a previously used tin, 34·66 and 40 in barley that had been used previously but since washed in water and put in a clean and a previously used tin, and only 1·25 in barley and a tin that had been used and not washed. Statistical analysis of the figures indicated that the only significant difference in percentage parasitism was that between the first four and the fifth, which was due solely to the contamination of the barley. About half as many puparia had been killed by insertion of the ovipositor of the parasite in the contaminated as in the clean grain, although eggs had not been laid in many of the former group. Parasitism was not appreciably reduced in tests in which ground host puparia were mixed with the grain to lessen the odour-stimulus of the host. Conditioning is therefore apparently not due to the fact that so many puparia have been mixed with the grain that the female parasites are unable to distinguish grains from true hosts.

VANDERPLANK (F. L.). **Apparent Densities of certain African blood-sucking Insects (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 4 6 pp. 68 72, 3 refs. London, 1944.

Tabanids and *Glossina* spp. were collected on 1–11 days in each month from November 1940 to August 1941 on a tethered ox in a hardpan area near Old Shinyanga in Tanganyika Territory. The ox was being used for attracting *Glossina*. Tables show total monthly catches and mean monthly catches for a specified period of both sexes of *Glossina swynnertoni*, Aust., and *G. pallidipes*, Aust., and of females of *Nuceria neavei*, Aust., three species of *Tabanus*, two of *Pangonius*, three of *Dorcaloemus*, and unidentified species of *Haematopota*. Data are also given on the monthly rainfall and mean maximum and minimum screen temperatures. The catching site and methods used are described. *Tabanus* and *Haematopota* were caught in most rainy months, but *Pangonius*, *Nuceria* and *Dorcaloemus* only during April and May, towards the end of the rains. *G. pallidipes* decreased in numbers from November to December and then gradually increased. *G. swynnertoni* increased during the rains and decreased during the dry season. *Tabanus* was active towards mid-day, when *Haematopota* was inactive except on cloudy days. *Pangonius* was most active at mid-day and during the afternoon. *P. zonatus*, Wlk., was taken in extremely large numbers during April, and it is suggested that it may be a factor contributing to the high incidence of trypanosomes in game at that period [*cf. R.A.E.*, B **30** 163].

MARSHALL (J. F.). **The Morphology & Biology of *Culex molestus* : observational Notes for Investigators.**—iv + 15 pp., 11 figs., 15 refs. Hayling Island, Hants., Brit. Mosq. Contr. Inst., 1944.

This review of knowledge on the morphology and biology of *Culex pipiens* var. *molestus*, Forsk. [*cf. R.A.E.*, B **30** 160, etc.], which the author considers a distinct species [*cf.* **25** 136 ; **27** 54], is divided into six sections. The distinctive features, stages of development and habits of mosquitos in general are described in the first, and the second and third deal, respectively, with the morphology and biology of *C. p. molestus*. Particulars of the English localities and types of breeding places in which it has been found are given in the fourth

section, measures suitable for controlling it are considered briefly in the fifth, and methods of collecting and rearing examples for identification are described and illustrated in the sixth.

Boardman (E. T.). **Methods for collecting Ticks for Study and Delineation.**—*J. Parasit.* **30** no. 2 pp. 57–59, 3 refs. Lancaster, Pa., 1944.

G. M. Kohls developed a method of collecting ticks from vegetation by using a white cotton-flannel flag about one yard square. This flag has been modified by the author by the addition of a strip of material, 4 inches wide, stitched down the middle of each face to form on each two narrow pockets in which the ticks tend to congregate. However, flags are relatively ineffective in the southern United States where the ground is warm, and ticks may be collected most effectively from ground litter among animal trails, etc., or by walking across country with a large dog, when they will congregate on the dog and also on the body and clothing of the collector. As soon as possible after death, the carcasses of trapped or shot native host animals should be examined for ticks on a white surface ; small hosts can be placed in a cotton-flannel bag that is closed by means of a drawstring and has a ruffle and a plug of cotton-wool in the mouth to prevent the ticks from escaping. Attached ticks that are wanted alive should have their mouthparts dissected free of the host skin ; others should be wetted with kerosene or some other thin oil. Unlike 70 per cent. alcohol, the fluid customarily used, a solution of ether and 20 per cent. ethyl alcohol (3 : 97) will kill ticks with their appendages expanded. For final preservation, the ticks should be kept in stoppered vials containing a solution of 75 per cent. alcohol and glycerine (9 : 1), but unengorged ticks may be dried, though this is less desirable. A method of staining chitin is outlined.

Papers noticed by Title only.

Williams (R. W.). **A Bibliography pertaining to the Mite Family Trombidiidae.**—*Amer. Midl. Nat.* **32** no. 3 pp. 699–712, 375 refs. Notre Dame, Ind., 1944.

Gillett (J. D.). **The Larva and Pupa of** [*Mansonia*] *Taeniorhynchus* (*Coquillettidia*) *maculipennis*, **Theobald** [from Uganda].—*Bull. ent. Res.* **35** pt. 4 pp. 395–397, 3 figs., 3 refs. London, 1945.

Middlekauff (W. W.). **A new Species of** *Aëdes* [*mathesoni*, sp. n.] **from Florida (Diptera : Culicidae).**—*Proc. ent. Soc. Wash.* **46** no. 2 pp. 42–44, 1 fig. Washington, D.C., 1944.

Lillie (R. D.) & Smith (M. I.). **Pathology of experimental Poisoning in Cats, Rabbits, and Rats with 2, 2 bis-parachlorphenyl-1, 1, 1 trichlorethane.**—*Publ. Hlth Rep.* **59** no. 30 pp. 979–984, 4 refs. Washington, D.C., 1944.

Smith (M. I.) & Stohlman (E. F.). **The pharmacologic Action of 2, 2 bis (p-chlorphenyl) 1, 1, 1 trichlorethane and its Estimation in the Tissues and Body Fluids.**—*Publ. Hlth Rep.* **59** no. 30 pp. 984–993, 8 refs. Washington, D.C., 1944.

Nelson (A. A.), Draize (J. H.), Woodard (G.), Fitzhugh (O. G.), Smith jr. (R. B.) & Calvery (H. O.). **Histopathological Changes following Administration of DDT to several Species of Animals.**—*Publ. Hlth Rep.* **59** no. 31 pp. 1009–1020. Washington, D.C., 1944.

SANDERS (R. N.). **A blood-sucking Mite of Poultry.**—*Agric. J. Fiji* **15** no. 1 p. 27, 2 refs. Suva, 1944.

Liponyssus bursa, Berl. (tropical fowl mite) was recorded in Suva about two years ago, and *Dermanyssus gallinae*, Deg., was recently found on fowls in Fiji for the first time. As both these mites can be very injurious to fowls, brief notes are given on their habits and methods of controlling them.

GINSBURG (J. M.). **Mosquito Oils, Larvicides, Repellents, Outdoor Sprays and their Application.**—*Bull. N. J. agric. Exp. Sta.* no. 711, 12 pp., 2 figs., 16 refs. New Brunswick, N.J., 1944.

This bulletin on temporary mosquito control measures deals with desirable properties for larvicidal oils [*R.A.E.*, B **32** 129], the quantity that should be applied, the use as larvicides of soap [**22** 87], water-miscible phenol preparations [**30** 12], and the emulsion of oil containing pyrethrum extract known as the New Jersey larvicide [**23** 205], and of Paris green dust against Anopheline larvae, equipment for the application of dust and liquid larvicides, spraying with the New Jersey larvicide against adult mosquitos in the open [**24** 34], and the use of repellents for personal protection and applications to alleviate irritation from mosquito bites.

HERMS (W. B.) & GRAY (H. F.). **Mosquito Control. Practical Methods for Abatement of Disease Vectors and Pests.**—2nd edn. (revd.), $9\frac{1}{2} \times 6\frac{1}{4}$ ins., xiv+419 pp., 11 pls., 86 figs., 1 fldg. chart. New York, N.Y., Commonwealth Fund; London, H. Milford, Oxf. Univ. Pr., 1944. Price $3.50 or £1.

This second edition of a work already noticed [*R.A.E.*, B **29** 113] has been revised and enlarged to meet the requirements of the United States forces during the war and in countries they will occupy. An appendix has been added on the identification of mosquitos and the use of entomological keys, and there are also lists of the mosquito vectors of yellow fever, dengue, *Filaria* (*Wuchereria*) *bancrofti*, and the types of epidemic (virus) encephalitis that occur in the United States, showing their typical breeding places and the regions in which they are found, and a chart of the principal malaria vectors of the world, grouped geographically and by typical breeding places, with appropriate control measures indicated.

The chapter on larvicides contains information on the effectiveness of 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane (DDT) against mosquito larvae, including accounts of some apparently hitherto unpublished experiments by the authors. Used at $\frac{1}{2}$–2 lb. per acre as a dust diluted with powdered talc (1 : 4) or calcium stearate (1 : 1), it has a more lasting effect than Paris green. Dissolved in acetone, dispersed in water and sprayed, it appears to be several times more toxic than phenothiazine, and dissolved in kerosene or petroleum distillate (2·5 per cent. solution), it is highly effective when applied at 0·1 lb. per acre. In laboratory tests made by the authors against *Culex tarsalis*, Coq., DDT dissolved in ethyl alcohol and applied to water at rates of 1 : 1,000,000, 1 : 6,000,000 and 1 : 100,000,000 by weight killed all of 50 larvae in 25 minutes, less than 12 hours and 12 hours, respectively, and dilutions of 1 : 6,000,000 and 1 : 100,000,000 killed all of 10 pupae in less than 36 and 48 hours. A dilution of 1 : 600,000,000 killed 45 of 50 larvae and 4 of 10 pupae in 48 hours. A field test was made in December 1943 against larvae and pupae of *C. tarsalis* in a drain containing slightly muddy water with a high dissolved organic content. Over 300 larvae and 100 pupae were trapped in a corner of the drain with an area of 6 sq. ft. and an average depth of 3 inches, and enough DDT was applied to give

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a dilution of 1 : 100,000,000. No larvae were found at the surface after 20 hours and many pupae were apparently in distress, and only one fourth-instar larva and six pupae were alive six hours later. Larvae and pupae in other parts of the drain were normal. DDT has considerable residual effect. Small glass jars that had contained it at a dilution of 1 : 1,000,000 were emptied and fresh water, larvae and pupae were put in. All larvae and pupae were dead on the following morning, and the jars were then emptied and refilled with the same result.

A mixture of 90 per cent. phenothiazine and 10 per cent. of a wetting agent such as sodium lauryl sulphate has been used by the U.S. Public Health Service to treat artificial containers against mosquito larvae, particularly *Aëdes aegypti*, L. The quantity used, about 2–4 gm. per 50 U.S. gals., will keep the water free from mosquito larvae for several months. It may be applied as a powder or by painting paper with a mixture of phenothiazine, wetting agent and a glue of brown flake gelatin and allowing it to dry, cutting it into pieces about 1 inch square and dropping them into the water at the rate of 1 square per U.S. quart.

Cooley (R. A.) & Kohls (G. M.). **The Genus *Amblyomma* (Ixodidae) in the United States.**—*J. Parasit.* **30** no. 2 pp. 77–111, 12 figs., 61 refs. Lancaster, Pa., 1944.

The adults of both sexes of the six species of *Amblyomma* already known to occur in the United States, the nymphs of five of them and of *A. avecolens*, sp. n., and the larvae of four are described, their synonyms if any, are shown, and notes are given on their hosts and distribution. Keys to the described adults and nymphs are also given. *A. avecolens*, of which the adult and larva are unknown, was taken on various birds in Texas, British Honduras and Panama. The medical and veterinary importance of members of the genus in the United States is briefly reviewed. *A. americanum*, L., transmits spotted fever [*cf. R.A.E.*, B **32** 45, etc.] and is probably a vector of tularaemia, as the bacteria have been shown to survive in it from the larval to the adult stage. Ten strains of *Rickettsia diaporica*, the agent of American Q fever, have been recovered from it in Texas [**32** 143] and it is the most likely vector of Bullis fever [**32** 132–133]. A rickettsia pathogenic to guineapigs has been recovered from *A. maculatum*, Koch, in Texas [**28** 28]. *A. cayennense*, F., carries Brazilian and Colombian spotted fevers [**31** 78; **32** 39] and is a potential vector of the spotted-fever rickettsia of the United States, though natural infection has never been found. *A. cayennense* and *A. americanum*, the larvae, nymphs and adults of which attack man freely, are particularly annoying pests because of their very long hypostomes, which are usually left in the skin when the ticks are removed by pulling. *Amblyomma* spp. are most important in relation to domestic animals because of the debility caused by massive infestations.

Herman (C. M.). **Notes on the pupal Development of *Stilbometopa impressa* (Diptera : Hippoboscidae).**—*J. Parasit.* **30** no. 2 pp. 112–118, 12 refs. Lancaster, Pa., 1944.

Stilbometopa impressa, Big., a Hippoboscid that commonly attacks quail in California, has been recorded only from species of *Lophortyx*. Work is in progress to determine whether it carries *Haemoproteus lophortyx* of which the only known vectors are species of *Lynchia* [*R.A.E.*, B **19** 90; **25** 236]. The studies reported in this paper were made with material collected from *Lophortyx californica vallicola*. The methods are described. Many pupae were obtained when 18 or more flies were placed in a cage with one or two quails, but only a few, if any, when a similar number of flies was placed with seven quails, because the birds ate the flies. The longest time that a fly remained alive off the host was five days. Apparently, females normally leave the host for larviposition, which may occur at any time of day. Larviposition and the appearance of the

larvae are described; the puparia required 2–16 hours to become shining black. The pupal stage lasted 61–162 days according to season, or less in preliminary experiments. Males and females were produced in almost equal numbers.

DAVID (W. A. L.) & BRACEY (P.). **Activation of Pyrethrins in Fly-sprays.**—*Nature* **153** no. 3889 pp. 594–595, 3 refs. London, 1944.

The efficiency of many sprays containing oil (odourless distillate), pyrethrum extract and an activator was tested against mosquitos (*Aëdes aegypti*, L.) exposed in a cabinet maintained at 28°C. [82·4°F.] and 70 per cent. relative humidity. With the atomiser used, there were practically no droplets of more than 7·5 microns diameter in a sample of the mist mechanically deposited in the test cage one minute after odourless distillate had been sprayed at 0·5 oz. per 1,000 cu. ft. The mosquitos, in paper-walled cages with wide-mesh gauze ends, were put into the cabinet four minutes after spraying and remained in it for ten minutes. A progressive delay in knock-down and increase in the percentage kill accompanied an increase in the activator content of the spray within certain limits. These facts, which were observed with four different activators, are illustrated by data on experiments with isobutylundecyleneamide. Since the insect receives its dose of insecticide by impaction with the spray droplets as it flies through the mist, the chance of its acquiring a heavy dose is increased by delaying knock-down. The importance of flight through the mist was confirmed by exposing simultaneously mosquitos that had not been chloroformed, had been chloroformed and had recovered, had been chloroformed but had had their wings removed before recovery, and had been chloroformed and were still motionless. The mortality percentages in these four groups after 24 hours averaged 62, 58, 13 and 12, respectively. The importance of the rate of movement of the insect in relation to the droplet and the relative momenta was demonstrated by making the spray mist move at known speeds past insects that had been chloroformed. The average kills after 24 hours when the speeds had been approximately 0·3 and 3·0 miles per hour were, respectively, 8 and 97 per cent.

Pyrethrins at 0·1 per cent. weight in volume, pyrethrins at 0·05 per cent., and 0·05 per cent. pyrethrins with 5 per cent. of an activator (sesame oil, isobutylundecyleneamide or lubricating oil) gave, respectively, after 24 hours, 96, 53 and 100 per cent. kill of chloroformed mosquitos that they passed at 3 miles per hour. Prolongation of the period of flight is thus shown not to be the only factor in activation. The three activators have a marked effect on the particle size and persistence of the mist because all have a low vapour pressure and persist when the more volatile carrier has evaporated. A comparison of non-activated and activated mists mechanically deposited after ten minutes from an atmosphere sprayed with approximately 0·5 oz. per 1,000 cu. ft. showed that, whereas there are few droplets per litre 5 microns or bigger with the former, there are very many thousands with an activated spray. This indicated that many substances of low vapour pressure would show this kind of activation, and olive oil, oleic acid, sesame oil free from sesamin and lubricating oil did so.

There seems little doubt that prolongation of the period of flight through the mist and increased persistence of droplets of the order of 10 microns in diameter contribute to activation, but a purely physical action does not explain the observation [*R.A.E.*, B **31** 8] that pure sesamin at 0·2 per cent. acts as an effective activator against the house-fly [*Musca domestica*, L.] while certain allied substances do not. Pure sesamin delayed knock-down and activated a spray of 0·05 per cent. pyrethrins in acetone and kerosene (10 : 90) against *A. aegypti*. When sesame oil, isobutylundecyleneamide or lubricating oil is used in the spray, the droplets left after evaporation consist of a more viscous and less concentrated solution than that resulting from an unactivated spray. It was originally thought that this delayed the penetration of pyrethrins and

therefore the occurrence of knock-down. However, this explanation does not account for the delaying effect shown by sesamin and so probably has little validity. Under suitable conditions, the particles that remain when a spray droplet evaporates are of the order of 1–10 microns when any of the activators mentioned in this paper (except sesamin) is used. Within this range, impaction occurs at lower velocities. It appears that there is an optimum final droplet size for securing maximum kill. If the droplet is too small, impaction with the insect does not take place ; if it is too large, the toxic principle is rapidly lost from the air space by sedimentation. For a given activator content of the spray, the final droplet size will depend on the size of the particles produced by the atomiser.

Bowen (C. V.) & Smith (L. E.). **Synthetic organic Compounds patented for Use as Substitutes for Pyrethrum.**—293 pp. multigraph. Washington, D.C., U.S. Dep. Agric., Bur. Ent., 1944.

Because the supplies of pyrethrum in the United States may be seriously curtailed by war conditions, much research has been carried out on possible substitutes for it. This publication is a catalogue of all organic compounds mentioned in United States patents up to 1st July 1941 as substitutes for pyrethrum or as adjuncts to replace it in part, especially in kerosene sprays for the control of the housefly [*Musca domestica*, L.]. The compounds are named according to the system used in the 1937 Decennial Index to Chemical Abstracts, other names used in the patents cited being listed as synonyms. The structural formulae are given where possible, and additional information, such as the physical properties and the results of insecticidal tests, is taken from the patents. These are listed separately by number.

Bowen (C. V.). **Organic Iodine Compounds tested against Insects, Fungi, and Bacteria. A Review of the Literature.**—20 pp., 111 refs. New York, N.Y., Iodine Educ. Bur., 1944.

In view of the present surplus of iodine in the United States and the possibility of producing synthetic iodine compounds with insecticidal value from some of it, the author reviews information on 294 organic iodine compounds, of which 112 have been tested for fungicidal or insecticidal action and the remainder for action against bacteria only. The compounds are named and arranged according to the scheme used in Chemical Abstracts, other names used in the references being retained as synonyms, and patent references are listed separately by number.

Brown (J. H.). **The Fleas (Siphonaptera) of Alberta, with a List of the known Vectors of Sylvatic Plague.**—*Ann. ent. Soc. Amer.* **37** no. 2 pp. 207–213, 6 refs. Columbus, Ohio, 1944.

A list is given of the 53 species of fleas known to be present in Alberta, where sylvatic plague occurs [*R.A.E.*, B **32** 186], showing their hosts and distribution there. Separate lists, based on the records of Eskey & Haas [**30** 128], are given of those among them that transmit plague and of the hosts on which these plague vectors have been found.

Sulkin (S. E.). **Recovery of equine Encephalomyelitis Virus (Western Type) from Chicken Mites.**—*Science* **101** no. 2624 pp. 381–383, 1 fig., 10 refs. Lancaster, Pa., 1945.

In the summer and autumn of 1944, an outbreak of encephalitis occurred among horses in Texas, with at least three cases of infection of man due to the western equine virus. In view of the recent isolation of the virus of St. Louis

encephalitis from *Dermanyssus gallinae*, Deg. [*R.A.E.*, B **33** 25], examples of this mite and the fowl tick (*Argas persicus*, Oken) and sera from fowls were collected from nine ranches on which cases of encephalitis had occurred in horses and from a farm on which a fatal case due to the western virus had occurred in a child. The presence of virus in a batch of mites from one of the ranches was demonstrated by inoculation and subinoculation of mice and guinea-pigs, details of the results of which are given, and the filtrable agent of the fifth mouse passage was identified as the western virus by neutralisation tests with sera of rabbits immunised against known strains of the western, eastern and St. Louis viruses. Virus was recovered in similar experiments from mites from the same ranch that had been kept without food for nine days. Three of seven samples of sera from fowls on this ranch contained neutralising antibodies for the western virus. No virus was obtained from mites from the other ranches or the farm or from any of the ticks ; experiments with the fowl sera had not been completed when the paper was written.

Mellanby (K.). **Experiments on Scabies Prophylaxis.**—*Brit. med. J.* no. 4350 pp. 689–690, 4 refs. London, 1944.

Immersion for three minutes at 20°C. [68°F.] in standard sheep dip, which was then allowed to dry on the body, killed only 50 per cent. of the scabies mites [*Sarcoptes scabiei*, Deg.] on two human volunteers. An experiment in a mental hospital indicated that one treatment of the whole body of all members of a community with benzyl benzoate emulsion would eradicate scabies. However, neither benzyl benzoate nor technical assistance is available to institute such treatment universally. In an investigation involving 250,000 inspections of school children, general treatment of the hands and wrists [*cf.* *R.A.E.*, B **31** 65] with benzyl benzoate twelve times at fortnightly intervals significantly improved the considerable decrease in scabies effected by examination followed by treatment of infested children and their families, but the difference was not sufficiently great to warrant the extra trouble and expense of treating everyone. It was found that scabies was scattered at random throughout each school, and there appeared to be little doubt that it was acquired mainly in the home, so that the exclusion of infested children from school is only necessary in so far as it ensures proper treatment.

Mellanby (K.). **Control of Crab Lice.**—*Brit. med. J.* no. 4351 p. 720. London, 1944.

In tests on 177 persons, one application of an emulsion containing lauryl thiocyanate was completely effective against *Phthirus* (*Phthirius*) *pubis*, L. It was prepared by adding 50 ml. technical lauryl thiocyanate to 20 gm. melted lanette wax S.X., heating the mixture to 60–70° C. [140–158°F.], pouring it into 950 ml. water at the same temperature, and stirring until cold. It was applied to the infested areas at the rate of less than 10 cc. per person, without previous shaving, and caused little discomfort. The clothing and bedding of each patient were disinfested, and no reinfestation occurred.

Bartley (W.), Unsworth (K.) & Gordon (R. M.). **The Rise in Incidence of Scabies in a closed Community using ordinary Soap, and its subsequent Fall on the Substitution of 5 per cent. Tetmosol Soap.**—*Brit. med. J.* no. 4392 pp. 332–333, 1 graph, 4 refs. London, 1945.

The value against *Sarcoptes scabiei*, Deg., of soap impregnated with only 5 per cent. tetraethylthiuram monosulphide (tetmosol) was tested on 400 of the women who had served as controls in Mellanby's experiment [*R.A.E.*, B **33** 59]. During the 18 weeks before they began to use the tetmosol soap,

the incidence of scabies among them increased from 4 to 9·2 per cent., 21 new cases being recorded. They then used the tetmosol soap instead of ordinary soap for 13 weeks ; the incidence of scabies had fallen to 1·7 per cent. with only one new case after the first six weeks and to 0·5 per cent. with no new case after the next seven. There was no case of dermatitis caused by the tetmosol [*cf. loc. cit.*].

Davis (L. J.). **Pulmonary Acariasis in Monkeys.**—*Brit. med. J.* no. 4396 p. 482, 1 fig., 3 refs. London, 1945.

In view of possible significance of mites in the causation of pulmonary disorders in man [*R.A.E.*, B **33** 11, 58], the author describes the histological characteristics of nodules that he found scattered through the lungs of a monkey and that contained mites, probably of the genus *Pneumonyssus*. He suggests the possibility that mites of this genus found in the lungs of monkeys normally exist as ectoparasites on the skin of the host, from which they are drawn into the air passages.

Neujean (G.). **Enquête sur une épidémie de typhus exanthématique (1939–1940).** —*Rec. Trav. Sci. méd. Congo belge* no. 2 pp. 7–46, 28 graphs, 7 refs. Léopoldville, 1944.

A mild but very widespread epidemic that broke out at the end of 1939 in Ruanda-Urundi, in the east of the Belgian Congo, was shown by the infection of guineapigs by inoculation of material from man, rats and lice [*Pediculus humanus*, L.] and by agglutination of Proteus OX 19 and OX 2 to be typhus, almost certainly of murine origin. No case of typhus had been recorded in the district between 1935 and 1939 [*cf. R.A.E.*, B **23** 298]. Practically the whole population was eventually involved, infection not having been apparent in most cases. This is thought to indicate transmission by fleas rather than lice. It was not possible to examine fleas for infection.

Jadin (J.). **Présence de typhus exanthématique murin à Coquilhatville.**—*Rec. Trav. Sci. méd. Congo belge* no. 2 pp. 47–51, 9 refs. Léopoldville, 1944. **La fièvre rouge congolaise est du typhus exanthématique murin.**—*T.c.* pp. 52–96, 24 figs., 22 refs.

It is recorded in the first paper that three strains of murine typhus were isolated in 1940 from seven lots of *Mus rattus rattus* (70 individuals) from various parts of Coquilhatville, Belgian Congo, by injection of brain suspensions into guineapigs, and that the serum of 27 of 160 examples of this rat agglutinated Proteus OX 19. This is thought to be the first time that the presence of murine typhus has been demonstrated in the Belgian Congo, apart from the work of Neujean [see preceding abstract].

In the second paper, details are given of observations on one induced and 19 natural cases of Congo red fever [*cf. R.A.E.*, B **27** 202] in the course of which it was concluded, from the results of injection into laboratory animals, the infection of *Pediculus humanus*, L. (*vestimenti*, Nitzsch) by rectal injection and by feeding on infested animals, and the infection of animals by the feeding or injection of infected examples of this louse, that the disease is murine typhus caused by *Rickettsia prowazeki* var. *mooseri*. It occurs all along the Congo and Ubangi Rivers in the Belgian Congo and affects both Europeans and Africans. It is endemic at Coquilhatville. A severe case was produced experimentally in a man on whom lice infected by rectal injection had fed. Congo red fever immunised against itself and against murine typhus, which also immunised against it. The Proteus most frequently agglutinated, however, was OXK, which suggests that the murine typhus of the Congo basin may be of a special

serological type. The rate of agglutination was never high. It is probable that the vector, as of other forms of murine typhus, is *Xenopsylla cheopis*, Roths., which transmits the infection either by bite or by its excreta. Attempts to effect transmission by the feeding or inoculation of *Aëdes aegypti*, L., failed [*cf. loc. cit.*]. It is stated in an addendum that a strain of Congo red fever immunised against South African strains of murine typhus in experiments at Johannesburg.

LIEGEOIS (P.). **Fièvre jaune au Congo Belge.**—*Rec. Trav. Sci. méd. Congo belge* no. 2 pp. 97–123, 1 fldg map, 11 refs. Léopoldville, 1944.

Until recently, cases of yellow fever in the Belgian Congo have been confined to ports [*cf. R.A.E.*, B **18** 168 ; **23** 38, 185], and it was generally supposed that it had been introduced and that a strict watch at the ports and rigorous control of *Aëdes aegypti*, L., there would suffice to protect the country from the disease. However, between 1932 and 1933, protection tests showed positive results for a fairly high percentage of the population in various parts of the Colony [**22** 175] and even for very young children, and six fatal cases were diagnosed by viscerotomy between 1937 and 1941 in six widely separated localities in the interior. Efforts to find other cases near them failed. A summary is given of the results of protection tests in the Province of Stanleyville from 1939 to 1941, on the basis of which the area can be divided into three regions. The first, in which positive sera were obtained from a fairly high percentage of the adults and some of the children, consisted principally of shrubby savannah intersected with forest, the second, in which positive sera were always obtained from some adults but none from children, was almost entirely equatorial forest, and the third, in which no positive sera were obtained from adults, was partly within the limits of equatorial forest and partly in little-wooded savannah.

A survey of the mosquitos of eleven localities in the Province of Stanleyville was made from 1939 to 1941, and the results are given, together with supplementary data on collections of *A. aegypti* from other districts, mostly in the same Province. Only 4 per cent. of the breeding places in which this species was found outside Stanleyville were not of the classic type, and these records may have been due to transfer of larvae from water containers. Over 97 per cent. of the larvae of *A. aegypti* identified were taken within 110 yards of dwellings and over 86 per cent. within 28 yards. *A. aegypti* indices are shown to be consistently higher in European towns than neighbouring native ones. The species of mosquito larvae found in five of the localities where the fatal cases occurred are shown in tables, and data are given on adults caught or reared in the sixth by C. Henrard. Though *A. aegypti* was present in all the localities, it was not observed to be abundant in any, and it is believed that the yellow fever is of the jungle type, as the facts observed indicate the existence of a reservoir other than man.

BOURGUIGNON (G. C.). **Le problème du paludisme dans la région d'Elisabethville.**—*Rec. Trav. Sci. méd. Congo belge* no. 2 pp. 165–203, 10 figs. Léopoldville, 1944.

Information obtained in 1932–40 on malaria at Elisabethville, Belgian Congo, is reviewed. It is shown that the incidence of clinical malaria generally begins to rise among natives about October, a month before the beginning of the rains, and remains high until May, the maximum being reached in April. It is highest among Europeans in May and decreases in both groups from May to October (the dry season). It becomes practically nil among Europeans at this time and may remain low until February. Incidence among natives is higher than among Europeans. The parasite is almost always *Plasmodium falciparum*. Gametocytes are extremely rare in Europeans. Some are usually found in natives in

February and March, and it is almost exclusively from the natives that Anophelines acquire transmissible infection. In 1933, Anophelines, like the malaria among the Africans, were observed to reappear before the beginning of the continuous rains. Rearing of mosquito larvae collected in the European quarter in March and April of one year yielded 37 adults of *Anopheles gambiae*, Giles (*costalis*, auct.) in the former month and 111 of this species and 25 of *A. maculipalpis*, Giles, in the latter. *A. funestus*, Giles, was not taken, but it is known to be frequent in houses and the increase in malaria incidence in April and May might well be connected with its life-history.

It appears that on the high plateau of Katanga, the completion of major sanitary works such as drainage and the suppression of tall non-woody vegetation, the provision and maintenance of a clear zone between European and native quarters and measures against *A. gambiae* and *A. funestus* would make it possible to maintain by personal prophylaxis the considerable reduction in European malaria that occurs naturally each dry season.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). **Morphologie des trypanosomes polymorphes des mammifères dans les glandes salivaires de** *G. palpalis*.—*Rec. Trav. Sci. méd. Congo belge* no. 2 pp. 204–211, 4 pls., 8 refs. Léopoldville, 1944.

Characters are given for distinguishing *Trypanosoma gambiense* from *T. brucci* and *T. rhodesiense* in fresh salivary glands of *Glossina palpalis*, R.-D., and stained preparations of them. There are no essential morphological differences. Differentiation is based on a characteristic appearance resulting from the distribution, frequency, size and position of the trypanosomes in the gland. No clear distinction was observed between the forms of *T. brucei* and *T. rhodesiense* in the salivary glands. *T. brucei* was not pathogenic to man and could always be identified by its pathogenicity to the dog. A strain of *T. rhodesiense* of doubtful identity from Uganda had not the typical appearance of this trypanosome, but more nearly resembled *T. gambiense* [*cf. R.A.E.*, B **25** 133]. The source from which the fly ingested the trypanosomes (different animals or a culture *in vitro*) did not affect their appearance in the salivary glands.

RISBEC (J.). **Un parasite des tiques du chien.**—*Notes afr.* no. 22 pp. 3–4, 1 fig. Dakar, 1944.

A brief description is given of an Encyrtid of the genus *Habrolepis* that has been found parasitising *Rhipicephalus sanguineus*, Latr., on dogs in French West Africa. The female oviposits in young ticks on the host, and the larvae feed on the eggs in the tick, which dies, and pupate in its abdomen. A dozen Encyrtids can develop in one tick.

PIROT (R.) & BOURGAIN (M.). **Non-transmission héréditaire de** *Spirochaeta persica* **Dschunkowsky 1912, chez** *Ornithodorus erraticus*.—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 20–23, 1 graph, 1 ref. Paris, 1944.

The usual vector of *Spirochaeta persica* appears to be *Ornithodoros tholozani*, Lab. & Mégn. [*cf. R.A.E.*, B **27** 150, 239; **31** 59, 129], but transmission has been effected experimentally by various ticks, including *O. erraticus*, Lucas [**25** 25]. The experiments recorded in this paper were made with a strain of *S. persica*, thought to have originated in Persia, that has been kept in the laboratory at Toulon for three years, is easily maintained in, and transmitted by, *O. tholozani*, and produces only a mild infection in guineapigs. More than

80 examples of *O. erraticus* that had engorged in the second nymphal instar in June 1940 on guineapigs heavily infected with this spirochaete failed to transmit the infection to fresh guineapigs 7, 8 or 9 months later when they were in the next instar, and no infection was seen in any of the rodents on which the ticks were subsequently fed.

CHORINE (V.) & COLAS-BELCOUR (J.). **Sur une souche tunisienne d'***Ornithodorus erraticus* **réfractaire à l'infection par** *Spirochaeta hispanica*.—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 24–34, 16 refs. Paris, 1944.

Accounts are given of experiments carried out in 1941–43 in which individuals of a strain of *Ornithodoros erraticus*, Lucas, bred from a single female from the neighbourhood of Tunis, failed to transmit two Moroccan strains of *Spirochaeta hispanica* from infected guineapigs on which they had engorged as larvae, nymphs or adults to uninfected guineapigs by biting or subsequent injection. An attempt at hereditary transmission, using larvae that were the offspring of a female that had engorged on an infected guineapig, was also unsuccessful. Both strains of the spirochaete were, however, transmitted by nymphs of a Moroccan strain of *O. erraticus* that had been infected as nymphs or larvae.

Various workers have found that some individuals of *Ornithodoros* differ from others of the same batch in ability to transmit spirochaetes. This has sometimes been attributed to immunity acquired during an earlier infection, but the Tunisian strain of ticks used in the present instance had been kept free from *S. hispanica* for twelve years. It has also been suggested that transmission can occur in some stages but not others [*R.A.E.*, B **19** 18, 91], but in this case all stages were tried with negative results. It is thought that racial immunity such as has been observed in other vectors of pathogenic organisms [**22** 167, etc.; **25** 251] is probably involved. If this is so, it will be necessary to determine the susceptibility of all strains kept for use in xenodiagnosis.

LWOFF (M.) & NICOLLE (P.). **Recherches sur la nutrition dès réduvidés hémophages. IV. Alimentation de** *Triatoma infestans* **Klug à l'aide de sérum de cheval. Action du glucose.**—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 38–51, 7 figs., 3 refs. Paris, 1944.

The studies recorded in this paper deal with the rearing of nymphs of *Triatoma infestans*, Klug, in the manner previously described [*R.A.E.*, B **30** 178] on horse serum alone or supplemented with one part glucose per thousand. The serum was obtained in quantity, and enough for several months' work was inactivated at 56°C. [132·8°F.] and stored in a refrigerator. Detailed data are given on the development of the batch of nymphs with which the most successful results were obtained, and briefer data on others; results obtained with haemolysed blood [**33** 62] and natural rearing on guineapigs [**31** 134] are quoted for comparison. No nymphs developed beyond the fourth instar on serum and glucose or beyond the third on serum alone. From the second instar onwards, nymphs reared on serum only weighed appreciably less than those reared on serum and glucose or haemolysed blood. The latter began to differ from each other considerably only in the fourth instar. Nymphs reared on serum showed frequent malformation of the appendages. They also developed much more slowly than those reared on blood and consequently ingested much more, except towards the end of life when their appetites were very small. Because the Triatomids can ingest large quantities of horse serum and it does not allow of their complete development, it is a suitable basic diet for research on the vitamins they require.

ROUBAUD (E.). **Sur la fécondité du moustique commun,** *Culex pipiens* **L.**—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 51–56, 9 refs. Paris, 1944.

Various authors have supposed that females of species of *Culex* and particularly *C. pipiens*, L., lay only one batch of eggs, or that some strains can

feed and oviposit once only while others can do so many times [*cf. R.A.E.*, B **12** 52]. Experiments are here described in which three females of a non-autogenous, eurygamic, anthropophilous strain and two of an autogenous, stenogamic strain, both from southern France, took several blood meals and laid two or more batches of eggs. The number of batches and of eggs laid by individual females varied considerably.

The author states that these two strains belong to the fundamental biotypes that he designated *C. p. pipiens* and *C. p. autogenicus* [**21** 267]. In a note on the nomenclature of the latter, he points out that the name *C. molestus*, Forsk., was originally proposed for a form of *C. pipiens* that attacked man in the Nile delta. He disapproves of the application of this or any other early name to the European autogenous form [**25** 136 ; **27** 54], since such synonymy can take no account of the physiological differences between the biotypes and must depend solely on indefinite colour characters and on readiness to attack man. The latter criterion is inadequate for differentiation, since some of the non-autogenous forms, including the one used in the experiments described above and *C. p. berbericus*, Roub., feed on man quite readily [**33** 63, etc.].

Lee (D. J.). **A new Species of the Genus *Anopheles* from northern Australia (Diptera, Culicidae).**—*Proc. Linn. Soc. N.S.W.* **69** pt. 1–2 pp. 21–25, 9 figs. Sydney, 1944.

The larva and adults of both sexes of *Anopheles* (*Anopheles*) *powelli*, sp. n., are described from the Northern Territory and Queensland, Australia. Larvae were found in shallow, overgrown swampy pools shaded by tall grass, and adults were taken in mosquito nets, some with blood in their abdomens.

Woodhill (A. R.) & Lee (D. J.). **The Subspecies of *Anopheles amictus* Edwards (Diptera, Culicidae).**—*Proc. Linn. Soc. N.S.W.* **69** pt. 1–2 pp. 62–66, 8 figs., 8 refs. Sydney, 1944.

The senior author has obtained evidence from a study of material from the Northern Territory that the typical *Anopheles amictus*, Edw. [*R.A.E.*, B **9** 133] and a variant that was mentioned by Edwards in the original description and has since been called Hill's variety or type C are morphologically distinct and show a considerable ecological separation and some distributional difference. Descriptions are therefore given of the egg, larva and adults of the variant, for which the name *A. a. hilli*, subsp. n., is proposed, together with additions to the first descriptions of the adult and larva of *A. a. amictus* [**9** 133 ; **16** 29]. Both forms are widely distributed in the north of Western Australia, Northern Territory, Queensland and northern New South Wales, and *A. a. hilli* also occurs in Netherlands New Guinea. The larvae of the latter are often found in brackish water with a salinity of as much as 4·2 per cent. and less frequently inland in fresh water. Records of *A. a. amictus* from brackish water are unusual.

Woodhill (A. R.) & Lee (D. J.). **Some new Records and new Synonymy of Australian Species of *Anopheles* (Diptera, Culicidae).**—*Proc. Linn. Soc. N.S.W.* **69** pt. 1–2 pp. 67–72, 2 refs. Sydney, 1944.

From an examination of the type material of the Anophelines recently described by Taylor [*R.A.E.*, B **32** 147], the authors conclude that *Anopheles perplexus*, *A. perplexus* var. *persimilis* and *A. derricki* (male) are synonyms of *A. annulipes*, Wlk., and that *A. breinli* and *A. derricki* (female) are synonyms of *A. punctulatus* var. *novaguinensis*, Venhuis, to which they accord specific status. English translations are given in appendices of the original descriptions of *A. novaguinensis* [**21** 110] and *A. meraukensis*, Venhuis [**20** 235], and both are recorded from Queensland and many places in the Northern Territory of

Australia. Characters are given distinguishing *A. meraukensis* from the two subspecies of *A. amictus*, Edw. [see preceding abstract]. In a paper already noticed [**13** 145], Hill figured as a variation of *A. punctulatus* var. *moluccensis*, Sw. & Sw., a wing that certainly belongs to *A. novaguinensis*.

Bishop (A.) & Gilchrist (B. M.). **A Method for collecting Sporozoites of *Plasmodium gallinaceum* by feeding infected *Aëdes aegypti* through Animal Membranes.**—*Nature* **153** no. 3893 pp. 713–714, 2 refs. London, 1944.

In view of the difference between blood-inoculated and mosquito-induced malaria in resistance to the action of known drugs, a method by which drugs can be tested directly on sporozoites is urgently required. Obtaining sporozoites by the dissection of salivary glands is unsatisfactory, as the sporozoites are always mixed with fragments of gland cells. The possibility of obtaining sporozoites free from gland tissue by feeding females of *Aëdes aegypti*, L., infected with *Plasmodium gallinaceum* through animal membranes was therefore examined. The most satisfactory membrane was one prepared by soaking the skin of a chick 1–3 weeks old in absolute alcohol for at least 30 minutes, washing it in tap water and stretching it over a piece of glass tubing, where it was kept in place until dry with a rubber band. The highest proportion of mosquitos engorged when the blood in the membrane (1·5–3 cc. heparinised chick blood) was warmed to 41–42°C. [105·8–107·6°F.] and kept warm by water at this temperature in a water-jacket. Moistening the outer side of the membrane with saliva also increased the rate of engorgement. The tube containing the blood is placed on the netted top of a jar containing the mosquitos so that the membrane rests on the netting, and engorgement takes place in the dark in a moist atmosphere at 28°C. [82·4°F.]. The rate and intensity of infection with *P. gallinaceum* obtained by feeding the mosquitos on heparinised chick blood heavily infected with gametocytes were equal to those obtained in mosquitos of the same age-group fed on the same chicken just before the blood was drawn for the membrane experiment. Moreover, infected mosquitos extruded sporozoites into uninfected blood when they engorged again through a membrane, and the sporozoites were viable, as blood containing them produced infections typical of mosquito transmission when injected into fresh chicks. Only batches of mosquitos of which members had been proved, by oöcyst count on the fourth-fifth day, to be heavily infected were used for obtaining sporozoites. The percentages of mosquitos that fed through the membrane were smaller in infected than in previously unfed individuals, but were usually at least 50 and sometimes 90. The infected mosquitos were allowed 30 minutes to engorge, and the blood was then removed with a pipette, shaken to ensure even distribution of the sporozoites and injected intravenously into chicks 5–10 days old at 0·4–0·5 cc. per bird. Groups of 3–4 chicks inoculated with blood from membranes through which batches of 35–53 mosquitos had engorged showed parasites in the peripheral blood on the sixth-seventh day. This incubation period was similar to that in chicks on which 2–4 heavily infected mosquitos had engorged. Infected females remain infective after engorging through a membrane and can eject sporozoites by this method more than once. One batch did so on the ninth day after infection, and again six days later.

A Symposium on a national Program for the Control of Malaria.—*J. nat. Malar. Soc.* **3** no. 1 pp. 5–73. Tallahassee, Fla., 1944.

The papers in this symposium comprise "American Mobilization for the Conquest of Malaria in the United States," by J. S. Simmons (pp. 7–10), in which the problems arising as a result of the war and the civil and military organisations that are co-operating against them are very briefly discussed; "The Malaria Control Program of the Army," by O. R. McCoy (pp. 11–14,

1 graph), which deals with the control of malaria in semi-permanent and fixed bases by adapting standard anti-mosquito measures, its control in forward areas by personal measures of protection and the training of soldiers in their application, and the prevention of the spread of malaria to civilians from returning troops ; " The Malaria Control Program of the Navy," by O. J. Brown (pp. 15–18), in which the differences between the organisations in the U.S. navy and army are briefly pointed out ; " The Malaria Control Program of the U.S. Public Health Service among Civilians in extra-military Areas," by S. B. Freeborn (pp. 19–23), which deals with the scope, organisation and methods of the Malaria Control in War Areas programme, including the provision of mobile units to inspect and carry out control measures if necessary around military establishments where concentrations of infected persons occur or are expected and to take prompt action wherever malaria breaks out as a result of the return of gametocyte carriers ; " Malaria Control Activities of the Pan American Sanitary Bureau," by H. S. Cumming (pp. 25–30), in which the progressive increase in the place occupied by malaria in the work of the bureau is traced, and activities connected with malaria are outlined ; " Malaria Control Activities of the Institute of Inter-American Affairs," by G. C. Dunham (pp. 31–38, 4 figs.), in which, to illustrate the type of work directed by the Inter-American Co-operative Health Services, the clearing of a lagoon in Honduras, where *Anopheles argyritarsis*, R.-D., and *A. albimanus*, Wied., were breeding, is instanced, the general plan of the services' control programmes is outlined, and many other items of malaria control work in various American countries are cited ; " Facilities for the Training of Malariologists in military and civil Institutions," by H. E. Meleney (pp. 39–44) ; " Contributions of the Bureau of Entomology and Plant Quarantine of the Department of Agriculture to the national Program for the Control of Malaria," by F. C. Bishopp (pp. 45–54, 18 refs.), in which the development of the bureau is outlined, and indications are given of its activities during the war years in connection with mosquito taxonomy, the making of surveys, and investigations on larvicides and sprays, aerosols and repellents against adult mosquitos ; " The Activities of the National Research Council in the national Program for the Control of Malaria," by G. A. Carden jr. (pp. 55–59), which deals with chemotherapy ; " A proposed Program to prevent the Spread of Malaria in the United States from infected Individuals returned from Abroad," by W. A. Sawyer (pp. 61–67, 9 refs.), the suggestions in which include the treatment of all infected troops until they are clinically free of the disease before discharge, survey and control of Anophelines around places where such persons are concentrated, notifying a malaria patient in writing of the diagnosis on discharge from a military hospital and instructing him to show a doctor the communication on the occasion of any subsequent illness within a year, the education of doctors in the diagnosis and treatment of malaria and the principles of prevention, instruction to medical technicians in government and private laboratories, the making of extensive malaria and Anopheline surveys, the suppression of the breeding of dangerous Anophelines by the destruction of larvae where their presence has been revealed by surveys, and the effective screening of houses and spray-killing of adult mosquitos as supplementary measures, and " A Program for the Eradication of Malaria from continental United States," by J. W. Mountin (pp. 69–73), in which it is considered that eradication might be effected by control of Anophelines, as areas of transmission are localised.

BATES (M.). **Notes on the Construction and Use of Stable Traps for Mosquito Studies.**—*J. nat. Malar. Soc.* **3** no. 2 pp. 135–145, 3 figs., 7 refs. Tallahassee, Fla., 1944.

As it was found in Egypt that Anophelines with outdoor resting habits tended to escape rather readily from the Magoon trap [*R.A.E.*, B **23** 302],

which the author prefers to call the Caribbean trap, it was modified by arranging the ingress slit in the horizontal instead of the vertical plane so that the mosquitos could not escape unless they flew downwards [*cf.* **28** 11]. The opening is placed at some distance in from the side of the cage to prevent the accidental escape of mosquitos flying against the side. This new Egyptian trap caught 4,000–5,000 mosquitos per night in Egypt, including as many as 1,000 Anophelines, and in further tests in Colombia took over seven times as many mosquitos and *Anopheles* as the Caribbean trap. The dimensions that were found most suitable are given. More mosquitos were retained if the ingress baffle was made of wire netting stretched taut so that wooden supports, which served to make the opening more conspicuous, were not needed. Making the roof of transparent materials did not decrease loss of Anophelines at daybreak in Egypt. Cellophane-filled aluminium gauze was always used in Colombia. Where traps have to be carried to the forest by hand, sides may be built of two sections instead of one. Where a donkey or calf is to be the bait, it is advisable to have a door at each end. A cement platform surrounded by a moat to exclude ants is convenient. The possibility of using stable traps for studies of host preference is discussed with reference to tests made in Egypt. With regard to their use for the study of seasonal distribution, data obtained in 1942 on *Anopheles rangeli*, Gabaldon, and *Psorophora cingulata*, F., at Villavicencio, Colombia, are given. The finding that captures in a stable trap fall after the first night in any one situation [**29** 179], is discussed. This occurred in the author's experience also but not to so great an extent.

Synthetic Roach Powders. Use of organic Thiocyanates in powdered Form for Roach Control in Place of Pyrethrum.—*Soap* **20** no 5 pp. 102–105, 2 figs. New York, N.Y., 1944.

Results are given of tests in which Lethane A-70, a new thiocyanate preparation containing 90 per cent. β, β′ dithiocyanodiethyl ether, was compared with pyrethrum and sodium fluoride for the control of cockroaches (*Periplaneta americana*, L., and *Blattella germanica*, L.). The tests were made by a method in which the dust was projected upwards into an upright cylinder and fell evenly on a wire-gauze cage containing the cockroaches and by a tray method in which the cockroaches had to cross a ring of the powder to reach their food. In the cylinder method the cockroaches were removed to an observation cage after five minutes. A mixture of 10 per cent. Lethane A-70 and 90 per cent. of an inert dust gave about the same kill as ground pyrethrum flowers containing 1 per cent. pyrethrins and a higher kill than undiluted sodium fluoride. It was also shown by the tray method to be equal to the pyrethrum and superior to sodium fluoride in speed of action. Lethane A-70 did not apparently lose toxicity during an exposure of 17 weeks. Tests against *Cimex lectularius*, L., by F. Hazard showed that a dust containing 5 per cent. was superior, and one containing 10 per cent. much superior to pyrethrum powder containing 0·9 per cent. pyrethrins. Lethane A-70 is about one-fifth as toxic to mammals as derris or cubé containing 5 per cent. rotenone, but is said to irritate the mucous membrane of the nose and eyes of some persons.

Fales (J. H.) & Goodhue (L. D.). **Aerosols vs. Oil Spray Insecticides. A Study of comparative Efficiency.**—*Soap* **20** no. 7 pp. 107–108, 2 graphs, 5 refs. New York, N.Y., 1944.

Comparisons are recorded of the effectiveness against house-flies [*Musca domestica*, L.] of pyrethrum aerosols produced by liquid dichlordifluoromethane

and of sprays of pyrethrum extract in oil applied with a standard Peet-Grady atomiser to give the same dosage of pyrethrins. The aerosols were superior when discharged into a chamber already containing the flies, whether the exposure period was one, five or ten minutes, and more effective after 20 minutes than the sprays after five minutes, when the flies were introduced after these periods had elapsed and were exposed for ten minutes. Knock-down after ten minutes was about 7 per cent. greater with the spray, but the aerosol caused a knock-down of 74 per cent. when 20 minutes elapsed before the flies were exposed.

GOTHARD (N. J.). **Another View of Aerosol Efficiency.**—*Soap* **20** no. 7 pp. 113, 115, 1 ref. New York, N.Y., 1944.

An aerosol of the formula now used (2 per cent. pyrethrum extract containing 20 per cent. pyrethrins, 8 per cent. sesame oil and 90 per cent. Freon [dichlordifluoromethane]) [*cf.* *R.A.E.*, B **31** 167 ; **33** 64], dispersed in a room at the recommended rate of 70 mg. pyrethrins per 1,000 cu. ft., gave 84 and 82 per cent. knock-down of flies [*Musca domestica*, L.] in ten minutes in two tests and 81 per cent. kill in both, while an AA grade spray of pyrethrum extract in oil used at 47·2 mg. pyrethrins per 1,000 cu. ft. gave knock-downs of 99 and 98 per cent. and kills of 92 and 91 per cent. Knock-down was effected rapidly by the spray, but slowly by the aerosol. In a Peet-Grady chamber, the spray gave higher knock-down and kill than an aerosol solution containing 4 per cent. pyrethrum extract when the amount of pyrethrins introduced was the same.

BARTHEL (W. F.), HALLER (H. L.) & LAFORGE (F. B.). **Pyrethrins for Aerosols. The Preparation of 98% pure Pyrethrins for Use in Freon Aerosol Bombs.**—*Soap* **20** no. 7 pp. 121, 135, 3 refs. New York, N.Y., 1944.

The authors describe a method of preparing a concentrate containing 90–100 per cent. pyrethrins, which retains its full effectiveness and may be made from crude materials. It contains nothing that might cause irritation or interfere with its use in aerosols by clogging the nozzle of the container [*cf.* *R.A.E.*, B **33** 73]. A commercial solution of 20–25 per cent. total pyrethrins in a high-boiling hydrocarbon solvent is agitated with nitromethane, which extracts the pyrethrins from their original solvent, but leaves most of the fatty acids, oils and other impurities. Three extractions with about equal volumes of nitromethane remove 97 per cent. of the total pyrethrins. Removal of the nitromethane solvent gives a concentrate that contains about 60 per cent. total pyrethrins and could be used for the preparation of the semicarbazones, but further purification is obtained by drawing the nitromethane solution through a column of activated carbon. A nearly colourless solution results, which yields a syrupy liquid containing 90–100 per cent. total pyrethrins on removal of the solvent in vacuum ; this amounts to 85 per cent. of the pyrethrins originally contained in the commercial product and furnishes a mixture of crystalline semicarbazones that closely approaches the theoretical yield.

Several similar commercial preparations were found to be suitable as starting materials, and no special quality of adsorbent carbon was required. A few commercial samples did not provide the anticipated quantities of pyrethrins and evidently underwent more rapid deterioration ; it appears that polymerisation with the formation of insoluble products may be involved. However, a 90 per cent. concentrate was obtained from such deteriorated material by digesting the nitromethane extract with petroleum ether, which dissolved the unchanged pyrethrins and left a viscous insoluble syrup that separated completely on standing, and evaporating the solvent.

In experimental work, 500 gm. 20 per cent. pyrethrum extract in deodorised kerosene was agitated with three successive portions of 250 ml. nitromethane. The emulsions sometimes encountered at this stage were readily dispersed by playing a high-tension spark on a copper wire dipping to the bottom of the vessel. The separated nitromethane solution was passed through an eight-inch column of activated carbon 1½ ins. in diameter, which was then washed twice with 100 ml. portions of nitromethane. The solutions were combined and the nitromethane was removed by distillation under reduced pressure. The remaining concentrate contained 98 per cent. pyrethrins, as determined by the A.O.A.C. method, and weighed 90 gm., which is equivalent to 90 per cent. of the pyrethrins in the original preparation.

Cox (A. J.). **Insecticide Testing. A Review of Test Procedure for evaluating Household Insecticides for Use in the Control of Flies, Clothes Moths, Roaches and Rodents.**—*Soap* **20** no. 6 pp. 114–117, 149, no. 7 pp. 123, 125, 129, 11 figs. New York, N.Y., 1944.

Descriptions are given of the procedures adopted by the Bureau of Chemistry of the Californian Department of Agriculture for tests of the effectiveness of household insecticides. They include a method of obtaining house-flies [*Musca domestica*, L.] of uniform age and vitality by rearing the larvae on a moist mixture of coarse, soft wheat bran, lucerne, malt extract and yeast at 80–85°F., the large-group modification of the Peet-Grady method of testing fly-sprays against them [*R.A.E.*, B **26** 245], and methods of rearing German and American cockroaches [*Blattella germanica*, L., and *Periplaneta americana*, L.] and of testing toxic powders and baits against them. The cockroaches are kept in wire baskets over large jars into which the newly hatched young fall. The baskets are moved once a week and the young cockroaches are thus kept in batches of fairly uniform age. In the case of American cockroaches, which eat their egg capsules, it is desirable to collect the capsules daily and place each week's supply in a separate jar. Powders are tested by making a ring of the material three inches wide on the top of a pedestal set in a dish and placing the cockroaches singly in the middle, so that they have to run through the powder to escape into the dish.

Davidson (J.). **On the Relationship between Temperature and Rate of Development of Insects at constant Temperatures.**—*J. Anim. Ecol.* **13** no. 1 pp. 26–38, 6 graphs, 25 refs. London, 1944.

The author gives an analysis of published data on the time required for the development of the egg and pupal stages of *Drosophila melanogaster*, Mg., at constant temperatures, in order to illustrate in detail the way in which his equation showing the relationship between temperature and the time required for development in insects [*R.A.E.*, A **31** 421] is calculated. In addition, the essential data relating temperature to embryonic development for *Musca domestica*, L., *Cochliomyia macellaria*, F., *Phormia regina*, Mg., and *Lucilia sericata*, Mg. [B **22** 255] and for *Ephestia kuehniella*, Zell. [A **23** 533] are used to demonstrate further the application of the equation.

It is concluded that the equation is of general application, representing the trend of the speed of development of insects for 85–90 per cent. of the complete range of temperature at which development is possible ; at temperatures above that at which development is most rapid, however, the observed values for rate of development are significantly less than the calculated ones.

VANDERPLANK (F. L.). **Studies of the Behaviour of the Tsetse-fly** (*Glossina pallidipes*) **in the Field : the Attractiveness of various Baits.**—*J. Anim. Ecol.* **13** no. 1 pp. 39–48, 1 fig., 9 refs. London, 1944.

An investigation was carried out at Shinyanga (Tanganyika Territory) between January 1939 and July 1940 to determine the relative effectiveness of various baits, including screens, for attracting *Glossina pallidipes*, Aust. The site and methods of the experiments are described, and the results are given in detail with statistical data. It is concluded that dog, ox and porcupine were the most attractive of the baits tested, with domestic pig and screen second, sheep, goat, man and baboon third and serval cat (*Leptailurus serval*), lion and jackal last. It was not practicable to compare several individuals of any species with several of all the others, so that it is possible that the differences found are individual and not specific, though this is considered highly improbable. Catches were made on both stationary and moving animals, but the former are considered the more satisfactory. A screen scented by contact with bush-pig (*Potamochoerus*) attracted more flies, but not significantly more, than an unscented one of the same size. However, it is stated in a foot-note that, in further work, screens scented with alcohol and ether extracts from the body surface of living bush-pig, ox and sheep were significantly more attractive than unscented screens. An unscented screen with an area of 2 sq. metres apparently caught more flies per square metre than one three-quarters the size.

PAPERS NOTICED BY TITLE ONLY.

PACKCHANIAN (A.). **An Apparatus to facilitate the Feeding of Insects on Laboratory Animals.**—*Amer. J. trop. Med.* **24** no. 4 pp. 273–275, 4 figs., 1 ref. Baltimore, Md., 1944.

SAUTET (J.), MARNEFFE (H.) & WITKOWSKI (M.). **Présence de l'***Ornithodorus erraticus* **(Lucas, 1849) au Soudan.**—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 36–37. Paris, 1944.

CALLOT (J.). **Sur un nouveau moustique arboricole :** *Aëdes* (*Finlaya*) *heracleensis* **sp. nov.** [in France].—*Bull. Soc. Path. exot.* **37** no. 1–2 pp. 56–59, 1 fig., 2 refs. Paris, 1944.

HAYES (W. P.). **A Bibliography of Keys to immature Mosquitoes (Diptera : Culicidae).**—*Ent. News* **55** nos. 6–7 pp. 141–145, 183–189. Lancaster, Pa., 1944.

HEWITT (R. I.). **Recent Research in avian and simian Malaria.** [Review of literature published in 1941–43.]—*J. nat. Malar. Soc.* **3** no. 2 pp. 95–109, 3 pp. refs. Tallahassee, Fla., 1944.

DE MEILLON (B.). **New Species of Ethiopian** *Simulium* **(Diptera).** [Two new species and one new variety from Kenya.]—*Proc. R. ent. Soc. Lond.* (B) **13** pt. 9–10 pp. 117–119, 1 fig. London, 1944.

RIVAROLA (J. B.). **Miasis intestinal humana por larva de** *Eristalis* **sp.** [A Case of Human Intestinal Myiasis caused by *Eristalis* sp. in Paraguay.]—*Rev. brasil. Biol.* **4** no. 2 pp. 239–241, 1 fig., 4 refs. Rio de Janeiro, 1944.

MacKichan (I. W.). **Rhodesian Sleeping Sickness in eastern Uganda.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 1 pp. 49–60, 1 map, 5 refs. London, 1944.

An epidemic of sleeping sickness that broke out in November 1940 had involved over 2,400 people and caused 274 deaths in the Busoga and Samia districts of the Eastern Province of Uganda up to the middle of 1943, when it was declining. The country affected, which lies along the northern shore of Lake Victoria from the source of the Nile to the Kenya border, is described, and previous epidemics that have occurred there are reviewed. The present one was shown to be caused by *Trypanosoma rhodesiense*. The species of *Glossina* that occur in the area are *G. pallidipes*, Aust., *G. palpalis*, R.-D., var. *fuscipes*, Newst., and *G. brevipalpis*, Newst.; the last is present in very small numbers only. *G. palpalis* occurs only along the shore of the Lake, along water courses and bordering a swamp, except in one area where it has penetrated some 10 miles inland from the Lake [*R.A.E.*, B **32** 189], the extension closely following the 50-inch rainfall contour. The northern boundary of the *G. pallidipes* belt varies with the season, but roughly corresponds with that of the epidemic area. *G. palpalis* was never far distant from an area where infection occurred, but *G. pallidipes* was always present and usually in greater numbers. Moreover, neighbouring areas where *G. palpalis* abounds but *G. pallidipes* is absent did not become infected. In 1943, C. H. N. Jackson carried out an experiment in which injection of blood from a rat bitten by *G. pallidipes* naturally infected with trypanosomes of the *brucei-rhodesiense* group in this area caused sleeping sickness in a human volunteer. Attempts to infect volunteers with blood from rats that showed polymorphic trypanosomes in the blood after they had been fed on by batches of *G. palpalis* from infected areas have so far proved negative, and the part played by this fly is still uncertain. The infection was probably introduced by labourers from the west of Lake Victoria.

Stiles (C. W.). **Isolation of the *Bacillus anthracis* from Spinose Ear Ticks *Ornithodorus megnini*.**—*Amer. J. vet. Res.* **5** no. 17 pp. 318–319, 1 fig., 1 ref. Chicago, Ill., 1944.

In September 1943, *Bacillus anthracis* was isolated, by agar culture of a suspension in saline solution and by injection into a guineapig, from a colony of about a dozen larvae and nymphs of *Otobius* (*Ornithodoros*) *megnini*, Dugès, taken from the ear of a cow that had died of anthrax in Colorado. Before being macerated, the ticks had been washed successively in tap water, 70 per cent. alcohol and boiling water and rinsed in sterile broth, which on culture proved negative for anthrax bacilli. Batches of two and four engorged nymphs from the ears of other cows that had died of anthrax showed no evidence of the presence of the bacilli. In view of the possibility that the ticks may spread anthrax, it is urged that infested carcasses of animals that have died of the disease should be promptly disposed of and greater care should be taken to keep herds free from *O. megnini*.

Featherly (H. I.) & Harmon (K. S.). **Preliminary Experiments with *Amorpha fruticosa* on Cattle Grubs.**—*J. Amer. vet. med. Ass.* **105** no. 812 pp. 291–293, 7 refs. Chicago, Ill., 1944.

The fruits and, to a smaller extent, the roots of *Amorpha fruticosa*, a leguminous shrub that occurs throughout central North America, are known to contain a substance poisonous to certain insects. Two experiments were carried out in Oklahoma in 1943 and 1944 to determine its toxicity to cattle grubs [*Hypoderma*]. The acetone extract of 100 gm. ground fruit, from which the excess acetone had been distilled, was made up to a litre with distilled water to form a 10 per cent. emulsion, which was rubbed into the infested area of the

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animal's back, either diluted or undiluted. Four steers were used in the first experiment and ten yearlings in the second. It was not possible to reach definite conclusions with so few animals, but the results indicated that the 10 per cent. emulsion is promising, that weaker emulsions are unsatisfactory, and that the addition of soap to the 10 per cent. emulsion as a wetting agent reduces its effectiveness. One application of the 10 per cent. emulsion kills all the larvae that have pierced the skin but does not injure the others. Three applications at suitable intervals should give complete control.

MACKIE (T. T.), HUNTER III (G. W.) & WORTH (C. B.). **A Manual of tropical Medicine.**—9½×6 ins., xix+727 pp., 287 figs. (6 col.). Philadelphia, Pa. & London, W. B. Saunders Co., 1945. Price £1 10*s*.

This comprehensive work was prepared to provide a concise account of recent knowledge on the principal tropical diseases and to include some hitherto unpublished information. It is divided into eleven sections, the first nine of which deal, respectively, with virus diseases, including epidemic tick-borne and mosquito-borne encephalitis, lymphocytic choriomeningitis, poliomyelitis, yellow fever, dengue and sandfly fever; rickettsial diseases, namely epidemic and murine typhus, the American spotted fevers and related tick-borne diseases, the scrub typhus group, Australian and American Q fevers, and trench fever; spirochaetal diseases, including louse-borne and tick-borne relapsing fevers, yaws and pinta (carate); bacterial diseases, including plague, tularaemia and intestinal diseases caused by bacteria mechanically transmitted by *Musca domestica*, L.; mycotic diseases; protozoal diseases, including amoebiasis, the various forms of leishmaniasis, sleeping sickness, American trypanosomiasis caused by *Trypanosoma cruzi*, and malaria, which is discussed at some length; helminthic diseases, including those caused by *Filaria* (*Wuchereria*) *bancrofti*, *F.* (*W.*) *malayi*, *Onchocerca volvulus* and *F.* (*Loa*) *loa*; nutritional diseases; and miscellaneous conditions, including bartonellosis and infestation by *Sarcoptes scabiei*, Deg.

The aspects discussed include in most cases, distribution, etiology, epidemiology, pathology, clinical characters and diagnosis, treatment and prophylaxis. Tables are given showing the causal agents, usual vectors to man, reservoirs, serological reactions and other diagnostic features in man and the reaction in laboratory animals following intraperitoneal inoculation of the various rickettsial diseases. Other tables show the principal vectors of malaria in various parts of the world (also the nature of their breeding places, the behaviour of the adults and their effectiveness as vectors), the vectors of tick-borne relapsing fever, the various forms of leishmaniasis and sleeping sickness, the known and probable vectors of *F. bancrofti*, the suspected vectors of *F. malayi*, the important vectors of plague and the species of Triatomids reported to be vectors of *Trypanosoma cruzi* and those that have been found infected in the United States. There are distributional data in nearly all cases.

Arthropods that carry disease or cause disease or discomfort are considered in the tenth section. A table is given showing the causal agent, geographical distribution, vector or intermediate host, reservoir and procedure for diagnosis of the various Arthropod-borne diseases, and the situation of the causal agent in man, and others showing the distribution and effect of the various Arthropods that cause poisoning or dermatitis. Brief notes are then given on the less important groups, including scorpions and poisonous spiders, and fuller information on the more important ticks and insects, bearing on such points as life-history and habits, medical importance, distribution, hosts and control. There are also morphological notes and numerous keys, and tables on chemical control and the types of myiasis in man.

The final section consists of instructions for carrying out various laboratory operations in connection with the diagnosis of disease.

MELLO (M. J.) & CUOCOLO (R.). **Técnica para o xenodiagnóstico da habronemose gástrica dos equídeos.** [Technique for the Xenodiagnosis of Gastric Habronemiasis of Equines.]—*Arq. Inst. biol.* **14** pp. 217–226, 1 pl., 1 fig., 17 refs. São Paulo, 1943. (With a Summary in English.)

Habronema muscae, H. megastoma and *H. microstoma,* which are transmitted by flies, are very harmful to horses when they develop in skin lesions, in the lungs or on the conjunctiva, but are of little importance and difficult to detect when they occur in the stomach. Stomach infections are commonest and serve as reservoirs of dispersal for these Spirurids. They can be controlled in the stomach by administering anthelmintics, and their spread prevented by applying disinfectants to the dung of affected animals or preventing flies from breeding in it, but these methods are expensive and not always practicable, and furthermore, microscopic examination of the dung does not always reveal the presence of the worms. A method of detection by xenodiagnosis [using *Musca domestica*, L., in the case of *H. muscae* and *H. megastoma*, and *Stomoxys calcitrans*, L., in that of *H. microstoma*] has been described [*R.A.E.*, B **22** 14], and the authors have evolved a simplification of it as a result of experiments with *H. muscae* and *M. domestica* [see next abstract].

About 20 eggs of the fly are placed on dung of the animal under test in a metal cylinder and covered with filter paper of a diameter slightly less than that of the cylinder. Cotton-wool is placed on the filter paper and moistened daily. The cylinder is covered with an inverted metal funnel, which fits closely to it, and the stem of the funnel projects into an inverted test tube through a hole in the cork. In order to hasten the development of the flies, the apparatus is kept at a temperature of 37–39°C. [98·6–102·2°F.]. The adult flies emerge in 7–8 days under these conditions, pass the filter paper and are attracted by phototropism into the test tube, from which they are collected and dissected in normal saline. Infection can also be shown by allowing the flies access to normal horse serum, when they will spontaneously liberate the larvae into it [*cf.* **13** 130]. The number of larvae in a single fly is variable ; in the authors' experiments, up to 60 were observed in a single head. It appeared that examination of only one fly in a batch was necessary, since if Spirurids were present in the dung, all the flies became infected. Repeated tests with dung from the same animals always gave the same results.

The process can be shortened by examining larvae or pupae of the flies, but this is more difficult. The larvae should be at least 2–3 days old, so that under the conditions described, they can be examined 3–4 days after the beginning of the test. Pupae are generally present on the sixth day. Examination of the adult flies is considered preferable, however, and characters are given distinguishing the larvae of *Habronema* from those of other Nematodes that may occur in them. The method can be used throughout the year, although in cold winters, when horse dung is less nutritive, yeast [*cf.* **15** 148] or pig dung [*cf.* **19** 197] should be added to it. Of 1,233 equines of which the dung was examined in São Paulo by ordinary methods in 1938–42, none was shown to be infected with *Habronema*, whereas of 150 horses and 51 donkeys examined by xenodiagnosis in 1942–43, 87 of the former and all the latter were shown to be infected.

MELLO (M. J.) & CUOCOLO (R.). **Alguns aspetos das relações do *Habronema muscae* (Carter, 1861) com a mosca doméstica.** [Some Aspects of the Relations between *H. muscae* and *Musca domestica*.]—*Arq. Inst. biol.* **14** pp. 227–234, 1 pl., 14 refs. São Paulo, 1943. (With a Summary in English.)

An account is given of laboratory experiments on the mannner in which *Musca domestica*, L., becomes infected with the larvae of *Habronema muscae* from the dung of horses, carried out in connection with the development of a technique of xenodiagnosis [*cf.* preceding abstract]. The results showed that

the Spirurids did not penetrate the shell of the eggs of the fly, that the larvae of the fly became infected not less than one or more than three days after they hatched, which suggests that they acquire the infection by ingestion, and that horse dung remained infective for not longer than eight days. Dissections of infected larvae showed that the Spirurids become localised in the fat-body, where they cause necrosis and the formation of cyst-like bodies. They remain there during the pupal stage, but after the emergence of the adult fly, the cysts break open and the Spirurids migrate to the head. Many of them reach the head by the second day, most by the third, and all by the fourth.

Wood (S. F.). **Notes on the Feeding of cone-nosed Bugs (Hemiptera, Reduviidae).** —*J. Parasit.* **30** no. 3 pp. 197–198. Lancaster, Pa., 1944.

Although many adults of *Triatoma longipes*, Barber, have been collected from the Alvarado Mine in Arizona [*cf. R.A.E.*, B **32** 57], their breeding places have not been found. In observations made in 1942, nymphs of this Triatomid as well as those of *T. rubida*, Uhl., and *T. protracta*, Uhl., fed on the blood of reptiles and other cold-blooded vertebrates with which they were confined. It thus appears that *T. longipes* in Arizona is not entirely dependent on warm-blooded animals for its food [*cf.* **17** 145].

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **15** no. 2 pp. 45–50, 17 refs. Suva, 1944.

Notes are given on the breeding places of various mosquitos that occur in Fiji. *Aëdes scutellaris pseudoscutellaris*, Theo., was found breeding in February 1944 in leaf axils of *Alpinia* and more recently in fallen, broken shells of the introduced calabash (*Crescentia cujete*). In one case, there was no water in the shell, but only a mass of damp leaf-mould in which the larvae pupated. Also, larvae of *A. scutellaris horrescens*, Edw., which is confined to the Fiji Islands, were found in a hole in a tree (*Barringtonia speciosa*) containing only damp leaf-mould. *Culex fatigans*, Wied., and *A. aegypti*, L., breed in large numbers in diluted fowl manure if this is left about in tins. Recent research by Army medical units has indicated that *A. scutellaris pseudoscutellaris* may be a vector of dengue in New Guinea, and this seems to be the case in Fiji also, since it was more abundant than *A. aegypti* from August to October in certain parts of Suva [*cf. R.A.E.*, B **32** 102] and early in December at the height of the epidemic at Nadi. In experiments in April and May 1944 on the suitability of different kinds of dung for *Musca domestica vicina*, Macq., the percentages of the larvae that pupated were 36 in pig dung and 64 in cow dung [*cf.* **16** 253]. Horses in the Suva Peninsula, where the work was done, are too rare to be a serious source of flies in the town area.

Noaks (J. W.). **An Experiment on the Effect of Sodium Chloride upon the Larvae of *Culex pipiens* Lin.**—*Bull. Brooklyn ent. Soc.* **39** no. 2 pp. 52–53, 1 fig. Lancaster, Pa., 1944.

Batches of ten larvae of *Culex pipiens*, L., bred from females taken in New York in July 1943, were put, when 24 hours old, into solutions of sodium chloride varying in concentration from 0·001 N to 1·0 N. Yeast was added as food. The larvae in the control solution and those in solutions with concentrations of up to 0·225 N had pupated after 414 hours. The weakest solution that caused death had a concentration of 0·25 N, at which the larvae survived for 349 hours. They died in 24 hours when the concentration was 0·275 N and in shorter periods when the concentrations were higher; all died within two hours and within 15 minutes of each other when the concentrations were 0·6–1·0 N.

McDaniel (E. I.). **Mosquito Control in Michigan—1944.**—*Quart. Bull. Mich. agric. Exp. Sta.* **26** no. 4 pp. 297–302, 4 figs. East Lansing, Mich., 1944.

As a State-wide campaign for the control of mosquitos is not practicable in Michigan, recommendations are made for reducing their numbers over small areas. Suggested measures include draining or oiling breeding places, applying Paris green dust [against Anopheline larvae], or treating woodland pools covered with algae with copper sulphate to kill the algae and make the pools unsuitable for Anophelines. After the initial application of copper sulphate, pieces of copper wire or empty cartridge-cases will serve as a permanent source of copper in the pools. Spraying with 0·5 per cent. summer oil emulsion or with nicotine sulphate at 1 U.S. pint per 100 U.S. gals. water with the addition of 4–6 lb. soap is recommended for the control of adult mosquitos on lawns or in parks. The spray should be applied as a fine mist as soon as it has been mixed, preferably at a pressure of at least 200 lb. Grass should be sprayed first and then trees and shrubs from the ground upwards, the spray being finally shot up 10–15 ft. into the air, and allowed to drift beyond the area to be protected. About 35 U.S. gals. should be used to each 750 sq. ft. One application of nicotine sulphate in midsummer gives protection for two weeks or more.

Ozburn (R. H.). **Problems of medical Entomology of military Importance in Canada.**—*J. econ. Ent.* **37** no. 4 pp. 455–459. Menasha, Wis., 1944.

In the course of a survey to ascertain whether Arthropod-transmitted diseases occur in areas surrounding military establishments situated between Winnipeg and the Rocky Mountains in Canada, over 4,100 ground squirrels (*Citellus* spp.) and 700 other animals and birds were collected, of which some 500 and 130, respectively, showed macroscopic signs of disease, and about 8,000 fleas were taken from them, some 400 of which were specifically identified. Bacteriological and serological tests did not confirm impressions based on macroscopic signs that a few animals were harbouring plague bacilli. A list is given of the 11 species of fleas found, with the hosts on which they were taken. They included *Ceratophyllus* (*Opisocrostis*) *labis*, J. & R., *C.* (*O.*) *tuberculatus tuberculatus*, Baker, and *C.* (*Oropsylla*) *rupestris*, Jord., which occurred in 85 out of 101 collections identified and have been demonstrated to be potential vectors of plague. All three were taken on *Citellus richardsoni* and *Ceratophyllus rupestris* also on a weasel (*Mustela*). More than 2,000 ticks, chiefly *Dermacentor andersoni*, Stiles, were collected in southern Alberta and Saskatchewan. Tularaemia was found in rodents and a gull (*Larus pipixcan*) in several areas of Alberta as far north as Edmonton, and macroscopic signs suggested that it may be present in other prairie areas. It was also found in *Haemaphysalis* [*leporis-*]*palustris*, Pack., from hares (*Lepus americanus*). No ticks were positive for Rocky Mountain spotted fever. *Latrodectus mactans*, F., was present in parts of Alberta, but there are no records of troops being bitten and children handle the spiders freely.

A lotion containing thanite [fenchyl thiocyanoacetate] applied to the hair, left on overnight and then rinsed off is giving promising results for the control of head lice [*Pediculus humanus capitis*, Deg.] on women. No live eggs have been found following treatment. The same lotion is being tested on volunteers of both sexes against pubic lice [*Phthirus pubis*, L.] and appears to give satisfactory control, though it causes some irritation. Waste crank-case oil diluted with kerosene or diesel oil and applied with hand sprayers in the absence of wind to temporary ponds and sloughs gave good control of mosquito larvae in the spring of 1943, the population of one 700-acre slough being reduced from 360 to 3 larvae per cu. ft. from the beginning of oiling to its discontinuance.

McCoy (O. R.). **Relation of Insects to the Health of Military Personnel.**—*J. econ. Ent.* **37** no. 4 pp. 459–464. Menasha, Wis., 1944.

The various Arthropod-borne diseases that may be of importance to troops of the United States Army, particularly overseas, are discussed in groups according to their vectors.

Hardenbergh (W. A.). **Entomologists and the Sanitary Corps.**—*J. econ. Ent.* **37** no. 4 pp. 465–467. Menasha, Wis., 1944.

The various problems that confront entomologists in the United States Army in the present war are reviewed, and the entomologists' functions are outlined. The chief are technical supervision and advice in the control of pests, instruction, administrative work and particularly the organisation and running of malaria survey units, which operate in every war area where malaria is a problem making mosquito and parasite surveys, recommending control measures, checking the effectiveness of measures taken and keeping records.

Carpenter (S. J.). **Insect Control at Army Training Camps.**—*J. econ. Ent.* **37** no. 4 pp. 470–474. Menasha, Wis., 1944.

The training given to entomologists to prepare them for work on insects of medical importance with the United States Army is outlined, and brief notes are given on the procedure for controlling insects (notably mosquitos) in training camps in the United States.

Freeborn (S. B.). **The Malaria Control Program of the U.S. Public Health Service.**—*J. econ. Ent.* **37** no. 4 pp. 467–469. Menasha, Wis., 1944.
Bradley (G. H.). **Entomological Services on the Program for Malaria Control in War Areas.**—*T.c.* pp. 475–477.

The first paper contains an outline of the organisation and scope of the programme for Anopheline control in areas surrounding war industries or contiguous to military reservations [*cf. R.A.E.*, B **32** 207; **33** 96] and also includes reference to the proposal for eradicating malaria from the continental United States by reducing the population of Anopheline vectors to a point below the minimum level for effective transmission [*cf.* **33** 96].

In the second paper, it is explained that the entomological section of the organisation is responsible for gathering and interpreting data for use in planning the control of *Anopheles*, while the planning and actual execution of the operations are the function of the engineering section. The surveys are designed to provide information making it possible to limit control work to vector species and to localities where the vector is plentiful enough to be dangerous, and to assess the effectiveness of control work. It is estimated that control operations were effective in obtaining and maintaining satisfactorily low Anopheline densities in 92 per cent. of the more than 900 war establishments protected in 1942 and in the same percentage of the larger number of establishments protected during the following season.

Knipling (E. F.) & Dove (W. E.). **Recent Investigations of Insecticides and Repellents for the Armed Forces.**—*J. econ. Ent.* **37** no. 4 pp. 477–480, 2 refs. Menasha, Wis., 1944.

A summary is given of some of the results arrived at in work recently carried out in Florida on substances lethal to lice or repellent to mosquitos and other Arthropods attacking man. In attempts to find a powder for the control of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) that could be carried in a soldier's pack, rotenone and pyrethrum showed most promise, the latter

being preferable on account of its more rapid action and because it did not cause any unfavourable reaction on the skin. On the basis of research with synergists for pyrethrum, powder MYL was recommended. This powder, the formula of which is given as 0·2 per cent. pyrethrins (using a 20 per cent. pyrethrum concentrate), 2 per cent. N-isobutylundecyleneamide, 2 per cent. 2, 4-dinitro-anisole (as an ovicide) and 0·25 per cent. Phenol S (anti-oxidant) in pyrophyllite, was more effective against *P. h. humanus* than other louse powders known to the investigators and also proved effective in controlling *P. humanus capitis*, Deg. (*P. h. humanus*, auct.) and *Phthirus pubis*, L.

As a result of early tests of mosquito repellents, three safe ones, dimethyl phthalate, Rutgers 612 [2-ethyl-1, 3-hexanediol] and Indalone [n-butyl mesityl oxide oxalate] were found to give good protection against *Aëdes* spp. and were recommended for use by the armed forces. They protect against *A. aegypti*, L., and *A. taeniorhynchus*, Wied., under experimental laboratory and field conditions for 3–5 hours. Rutgers 612 was most effective against *Aëdes* and dimethyl phthalate against *Anopheles quadrimaculatus*, Say. Indalone was of little value against the Anopheline but was the best against *Stomoxys calcitrans*, L. The repellents were effective for much longer on clothing than on the skin, giving protection from *Aëdes taeniorhynchus*, *A. aegypti* and *Anopheles quadrimaculatus* for about a week when 50–100 cc. was sprayed on a suit of clothing. The repellents in general are less effective when the users are exerting themselves and perspiring freely.

Dethier (V. G.) & Whitley (F. H.). **Population Studies of Florida Mosquitoes.** —*J. econ. Ent.* **37** no. 4 pp. 480–484, 3 refs. Menasha, Wis., 1944.

Data are given on the abundance and seasonal distribution of various species of mosquitos taken in a peninsula ten square miles in extent on the western coast of Florida over a period of 20 months in 1942–43. Brief notes on breeding places are included in many cases.

Lindquist (A. W.), Madden (A. H.) & Watts (C. N.). **The Use of Repellents against Fleas.**—*J. econ. Ent.* **37** no. 4 pp. 485–486. Menasha, Wis., 1944.

Many materials were tested as repellents against fleas in Florida in 1942 by rubbing 1 ml. on the arm of a white or coloured subject from wrist to elbow and exposing the arm at intervals of 15–30 minutes in a small cage containing 500–1,000 individuals of *Ctenocephalides canis*, Curt., and *C. felis*, Bch. No substances prevented the fleas from jumping on to the arm, but the effective ones caused them to leave immediately. The results obtained with the best 46 repellents, which gave complete protection for averages of 104 minutes or more, are summarised in a table. A mixture containing 1 per cent. pyrethrins and 2 per cent. IN-930 (N-isobutylundecyleneamide) in mineral oil gave protection for the longest average time (435 minutes), probably through knockdown rather than repellency, but could not be considered for practical use because of the scarcity of pyrethrum. Several other materials that were very satisfactory, including 2-ethylhexyl ether of diethylene glycol and n-hexyl ether of diethylene glycol, the average repellent times of which were 398 and 388 minutes, respectively, cannot be recommended for toxicological reasons or because of unavailability. Dimethyl phthalate, Indalone (n-butyl mesityl oxide oxalate) and Rutgers 612 (2-ethyl-1, 3-hexanediol), which gave protection for average periods of 260, 160 and 139 minutes, respectively, have the advantage of being available in the field, as they have been adopted by the armed forces of the United States as repellents against other insects. Any of these three materials applied to the clothing was found to protect the wearer from fleas for several days. It is recommended that 100–150 ml. be sprayed on the trousers and socks of soldiers about to enter infested areas or buildings.

PORTMAN (R. W.). **Winter Distribution of two Ectoparasites of the Cottontail Rabbit in Missouri.**—*J. econ. Ent.* **37** no. 4 p. 541, 2 refs. Menasha, Wis., 1944.

Ectoparasites were collected from 405 rabbits shot in January and February of 1943 and 1944 in 38 representative areas of Missouri with different soils. *Haemaphysalis leporis-palustris*, Pack., was found on the rabbits from six southern and south-western counties and partly engorged larvae of *Dermacentor variabilis*, Say, on the rabbits from the southernmost. All active stages of *H. leporis-palustris* were found, and some individuals of each stage, including adults of both sexes, had been feeding. No ticks were found on any of the rabbits taken from the more northern counties. These findings are compared with data obtained in Oklahoma [*R.A.E.*, B **31** 130], the northern border of which is at about the same latitude as the southern counties of Missouri. It is concluded that southern Missouri is probably the northern limit of the area where *H. leporis-palustris* is active throughout the year, that any rabbit shot in southern Missouri may be infested with tularaemia, which is spread by this tick, and that those likely to handle rabbits should be warned of this. Rabbits may, on the other hand, be handled with relative safety in January and February in the northern counties where the ticks hibernate.

The 667 fleas taken on the rabbits caught comprised 487 individuals of *Cediopsylla simplex*, Baker, 96 of *Hoplopsyllus affinis*, Baker, and 82 of *Odontopsyllus multispinosus*, Baker, all of which were well distributed, and one individual each of *Ctenocephalides felis*, Bch., and *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc.

PRYOR (J. E.) & CHAMBERLAIN (R. W.). **Differentiating the Larvae of *Uranotaenia* in the Southeast.**—*J. econ. Ent.* **37** no. 4 pp. 543–544, 1 fig., 2 refs. Menasha, Wis., 1944.

Characters are given for distinguishing the third- and fourth-instar larvae of *Uranotaenia sapphirina*, O.-S., and *U. lowi*, Theo., the two species of the genus that occur in the south-eastern United States.

QUINBY (G. E.), SERFLING (R. E.) & NEEL (J. K.). **Distribution and Prevalence of the Mosquitoes of Kentucky.**—*J. econ. Ent.* **37** no. 4 pp. 547–550, 11 refs. Menasha, Wis., 1944.

A list is given of 42 species of mosquitos that have been recorded in Kentucky since 1893, showing for each its prevalence in the different counties, the date and locality of the first record for the State, and the name of the collector. The species of *Anopheles* are *A. punctipennis*, Say, and *A. quadrimaculatus*, Say, which are widely distributed and common, and *A. barberi*, Coq., *A. crucians*, Wied., and *A. walkeri*, Theo., which are rarer. Much of the information is based on the results of a survey that has been in progress for over ten years, in the course of which 137,572 specimens in 13,563 collections have been examined.

O'NEILL (K.), OGDEN (L. J.) & EYLES (D. E.). **Additional Species of Mosquitoes found in Texas.**—*J. econ. Ent.* **37** no. 4 pp. 555–556, 8 refs. Menasha, Wis., 1944.

Records are given of the collection in Texas during 1943 and the first half of 1944 of three Anophelines and six other species of mosquitos that were not included in a recent list [*R.A.E.*, B **32** 155]. The Anophelines are *Anopheles crucians bradleyi*, King, *A. maculipennis freeborni*, Aitken, and *A. walkeri*, Theo.

Bushland (R. C.), Eddy (G. W.) & Knipling (E. F.). **Tests with Synergists for Pyrethrum against the Body Louse.**—*J. econ. Ent.* **37** no. 4 pp. 556-557, 1 ref. Menasha, Wis., 1944.

Sesame oil, D.H.S. Activator (ethylene glycol ether of pinene) and IN-930 (N-isobutylundecyleneamide) were among more than 200 compounds tested as synergists for pyrethrum in powders against *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.). The inside of a cotton sleeve was coated with 3 gm. pyrophyllite containing the desired amounts of toxic substance and synergist, the sleeve was put on the arm or leg, 25 young adult lice were introduced and the sleeve was fastened with adhesive tape. The results obtained with the three substances named are given. After 24 hours, a control dust containing 0·25 per cent. pyrethrins had killed 68 per cent. of the lice, while dusts containing the same amount of pyrethrins with the addition of 2 per cent. D.H.S. Activator, sesame oil or IN-930 had killed 94, 94 and 100 per cent., respectively. Neither of the synergists was toxic at 2 per cent. in pyrophyllite. In further tests, powders containing 2 per cent. IN-930 and 0·01 per cent. pyrethrins were completely lethal to lice. When 0·005 per cent. pyrethrins was used in combination with 0·25, 0·5, 1 and 2 per cent. IN-930, the percentages of lice surviving were, respectively, 32, 28, 11·5 and 3·5, and the lice surviving the last treatment were affected. It was shown that 2 per cent. IN-930 increased the initial toxicity of the pyrethrins about 100 times. In tests in which the lice were introduced after the treated sleeves had been worn for various periods, pyrophyllite powder containing 1 per cent. pyrethrins alone was effective for four days, but powder containing 0·2 per cent. pyrethrins and 2 per cent. IN-930 remained effective for at least eight days.

Telford (H. S.). **Chicken Louse Control.**—*Soap* **20** no. 8 pp. 113, 139. New York, N.Y., 1944.

The effectiveness of 4 per cent. DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane], 0·5 per cent. fixed nicotine (Black Leaf 155) and 33 per cent. sodium fluoride, all in pyrophyllite, was compared for the control of *Eomenacanthus stramineus*, Nitzsch, and *Menopon gallinae*, L., on two-year-old hens, each infested with at least 100 lice of each species. Six birds were treated with each dust and the same number with pyrophyllite as a control. The dusts were applied with a shaker, those containing DDT and nicotine at an average rate of 6·3 gm. per bird and the sodium fluoride dust at 7·8 gm. per bird. The nicotine apparently gave complete kill of *E. stramineus* in four hours, but considerable numbers of *M. gallinae* were still alive after 52 hours. No live lice of either species were found 28 hours after treatment with DDT, and none of *E. stramineus* 28 hours or of *M. gallinae* 52 hours after treatment with sodium fluoride. Each bird was searched for five minutes. No apparent reduction occurred in the louse population on control birds. The sodium fluoride was slow in action, no reduction in population being noticeable after four hours, but the DDT had caused a very marked reduction in this time. In a second trial, 12 gm. dust containing 0·5 per cent. DDT also freed all birds of lice within 28 hours. There were no harmful effects to operator or birds.

Trask (J. D.), Paul (J. R.) & Melnick (J. L.). **The Detection of Poliomyelitis Virus in Flies collected during Epidemics of Poliomyelitis. I. Methods, Results, and Types of Flies involved.**—*J. exp. Med.* **77** no. 6 pp. 531–544, 1 fig., 21 refs. Baltimore, Md., 1943. [Recd. 1945.]

Trask (J. D.) & Paul (J. R.). **II. Clinical Circumstances under which Flies were collected.**—*T.c.* pp. 545–556, 5 figs., 4 refs.

The first of these papers deals mainly with the technique used in demonstrating the presence of poliomyelitis virus in flies. Attempts made in the authors'

laboratory to isolate the virus from insects taken in the field during eight different epidemics in the eastern United States and Toronto between 1931 and 1940 are summarised. All results were negative, but this may have been because of deficiencies in the methods used or because the inoculated animals were not highly susceptible. Following the generalisation of the practice of using Java monkeys (*Macaca cynomolgus*) for the purpose, the virus was detected in three laboratories, including the authors', in samples of flies collected in epidemic areas during the summer and autumn of 1941 [*R.A.E.*, B **29** 195; **30** 93; **31** 17]. The results are here given of experiments made in that year, in which the virus was isolated in four out of 39 tests made with 19 samples of flies collected in epidemic areas in the eastern United States and New Brunswick, during and after the onset of human cases of poliomyelitis in the neighbourhood. Non-biting flies were caught in sterilised traps, usually baited with fish, set in the yard, near a privy or near a house in which a case or cases of poliomyelitis had occurred, and biting insects were collected with nets, sometimes from a cow placed in an epidemic area as bait. All the positive results were obtained with non-biting flies. The methods used in preserving the flies, preparing the inocula, inoculating monkeys with them and examining the inoculated animals are described. Both washings of flies and of the inside of the containers in which they had been stored and emulsions of ground-up flies were used. The virus was demonstrated in both, and there was no indication that the emulsions were inferior to the washings. Positive results were confirmed by successful passage to another monkey, and the identity of the virus by the negative results of attempted passage to guineapigs and mice. All positive results were obtained by the intranasal and intra-abdominal inoculation of *Macaca cynomolgus*. Tests with green African monkeys (*Cercopithecus aethiopus sabaeus*) and rhesus monkeys (*M. mulatta*) were all negative. The genera in 14 samples of non-biting flies were determined. *Phormia* (including *Protophormia*) and *Lucilia* (*Phaenicia*) were present in all the positive samples and nine of the negative ones. Several other genera were represented among the positive samples, but none was in all of them. *Musca domestica*, L., was found in only two of the four, and only in small numbers.

The environments in which some of the samples of flies were collected are discussed in the second paper. Data are given on results obtained with eight samples taken in epidemic areas 15–20 acres in size during epidemics (catch begun within ten days of the onset of a local case) and eight others taken after epidemics (more than ten days after the onset of the most recent local case). The four positive results were all obtained in the first group. The four sites from which the samples yielding them were obtained are described in some detail. Two were in camps in woodland and farming country in Connecticut, in one of which there were two proved intestinal carriers when the flies were collected and exposed human faeces within 100 ft. of the camp kitchen where the trapping was done, and in the other there were some suspected carriers and many privies. The third site was in Alabama near many privies, including one which was used by the occupants of houses in which three cases of poliomyelitis had recently occurred. There were also three proved carriers in the area. The fourth was on the premises of two households in New Brunswick in each of which one case had occurred. Brief notes are given on sites from which only negative samples of flies were obtained.

CASALS (J.) & WEBSTER (L. T.). **Relationship of the Virus of Louping Ill in Sheep and the Virus of Russian Spring-summer Encephalitis in Man.**—*J. exp. Med.* **79** no. 1 pp. 45–63, 9 refs. Baltimore, Md., 1944.

Details are given of comparisons of three strains of Russian spring-summer encephalitis, which is transmitted by *Ixodes persulcatus*, Schulze, with one of

louping ill of sheep, which is transmitted in Britain by *I. ricinus*, L. The studies comprised cross-resistance tests and complement fixation and neutralisation tests (including some made with serum of an individual who had recovered from an infection with louping ill acquired in the laboratory). All indicated that the two viruses are closely related but possibly not identical. No similarities were found between the reactions of these viruses and those of St. Louis encephalitis, West Nile virus, Japanese B encephalitis and Western equine encephalomyelitis.

GRUNDMANN (A. W.), KITSELMAN (C. M.), RODERICK (L. M.) & SMITH (R. C.). **Studies on the Transmission of the western Strain Virus of equine Encephalomyelitis by the American Dog Tick,** *Dermacentor variabilis* **Say and by** *Triatoma sanguisuga* **(LeConte).**—*J. infect. Dis.* **72** no. 2 pp. 163–171, 9 refs. Chicago, Ill., 1943. [Recd. 1945.]

As *Dermacentor andersoni*, Stiles, had been proved capable of transmitting the virus of western equine encephalomyelitis [*R.A.E.*, B **24** 295; **29** 190], the ability of the closely related *D. variabilis*, Say, to do so was studied. This tick has a much wider range than *D. andersoni*, as it occurs throughout the area east of the Rocky Mountains and in Oregon and Washington. However, attempts to obtain transmission by examples that had fed on infected guineapigs or rabbits were unsuccessful, though they were shown to have ingested infected blood. Virus was not demonstrable in recently moulted nymphs or adults that had engorged on infected animals before the moult, in eggs laid by females that had engorged on infected animals, or in larvae hatching from the eggs. An infective feed in the larval stage did not predispose nymphs to infection when they engorged on an infected animal. Partly engorged ticks that were induced to reattach on a normal guineapig failed to transmit the virus mechanically. Adult ticks became infected when virus was injected into the haemocoele, but they did not transmit the infection to a horse on which they engorged, and their progeny contained no virus.

Triatoma sanguisuga, Lec., has previously been found naturally infected with the western strain in Kansas and has transmitted it in the laboratory [**29** 38]. Individuals in various instars collected in Kansas from the burrows of *Neotoma floridana baileyi* and *Sigmodon hispidus texanus* were shown to be uninfected. They transmitted the infection from artificially infected guineapigs to normal guineapigs exposed to their bites, but the mechanism of transmission was not clear. In later experiments, liquid faecal material obtained from nymphs 15 and 22 days after an infective meal caused the disease in guineapigs inoculated intracranially with a filtrate of a suspension. Moreover, virus in sufficient quantity to cause death was shown to be able to enter the body of guineapigs through small abrasions, and there were indications that it might be able to enter through normal skin. It is concluded that it is possible for *Triatoma* to infect the host by faecal contamination. No infection was produced in a horse on which adults and nymphs infected artificially on guineapigs were allowed to feed. Several strains of virus were isolated from batches of *T. sanguisuga* taken in Kansas and one was identified as of the western type. Others were lost before they could be identified, but the erratic behaviour of one or more indicates that an entirely different type of virus may have been involved. Several batches of mosquitos, *Stomoxys calcitrans*, L., *Ornithodoros turicata*, Dugès, and *O. talaje*, Guér., were collected and examined for virus with negative results. Examples of *Neotoma f. baileyi* from Kansas and *Sigmodon h. hispidus* from the southern States were shown to be susceptible to experimental infection with both the eastern and western strains.

Boshell-Manrique (J.) & Osorno-Mesa (E.). **Observations on the Epidemiology of Jungle Yellow Fever in Santander and Boyacá, Colombia, September, 1941, to April, 1942.**—*Amer. J. Hyg.* **40** no. 2 pp. 170–181, 3 maps, 7 refs. Lancaster, Pa., 1944.

An investigation of forest vectors and reservoirs of yellow fever was carried out in San Vicente de Chucurí in the State of Santander del Sur, Colombia, from September to December 1941 and in Muzo in Boyacá from February to April 1942. The history of yellow fever in the two districts is reviewed, and their topography is discussed. In both, cultivated areas on the upper slopes are adjacent to forests at the bottom of the valleys. The same methods were used as in an earlier investigation at Villavicencio [*R.A.E.*, B **32** 183–184]. Blood-sucking insects were originally sought near the houses and plantations of persons suffering from yellow fever, but few mosquitos were taken. The undisturbed forests in the canyons were therefore searched. As a result of experience gained in the earlier work, mosquitos were caught principally from the foliage some 25–50 ft. above the ground, trees being shaken and in some instances felled to increase catches. The proportion of *Haemagogus* taken was considerably raised by this means [*cf.* **32** 184].

The 21 species of mosquitos taken in San Vicente de Chucurí included *H. capricorni*, Lutz, *H. equinus*, Theo., and *H. lucifer*, H., D. & K. This was the first time that species of *Haemagogus* other than *H. capricorni* had been shown to occur in Colombia. The females of the three species appear the same, but the fact that males could be caught in free flight in the forest and copulating pairs seen and netted, behaviour that had never been observed in *H. capricorni* in Colombia, indicated a probable specific difference, and final identification was made from material reared from larvae. A rhesus monkey [*Macaca mulatta*] was immunised from yellow fever by the bites of 175 females of *Haemagogus*, the species of which could not be determined. Virus was also recovered by trituration and injection into a mouse of a mixed batch of *Aëdes dominicii*, Rangel & Romero Sierra, and *A. leucocelaenus*, Dyar & Shannon. As previous investigations have shown that *A. leucocelaenus* carries yellow fever virus [**32** 184], whereas *A. dominicii* is not known to do so, it is considered probable that the former was responsible for the positive result. In Muzo, the virus was isolated four times from *H. capricorni* by mouse inoculation, and a rhesus monkey bitten by two of the lots of mosquitos became immunised. Another became immune after receiving bites from a batch of more than 400 mosquitos of the same species in which mouse inoculation failed to demonstrate the virus. Circulating virus was not demonstrated in either of the monkeys. Results with other mosquitos and miscellaneous blood-sucking Arthropods were all negative. Opossums with protective serum were found in both regions and some serological reactions obtained in San Vicente de Chucurí suggested recent infection. Monkeys have disappeared from this district owing to intensive cultivation, and none occurs in Muzo except small groups of *Aotus lanius*.

The finding of *Haemagogus* mosquitos at some distance from their breeding areas and of virus-carrying mosquitos in places removed from the probable sites of human infection suggested that sections of the mosquito fauna dispersed towards the higher parts of the valley at certain hours and under certain conditions. This hypothesis was supported by the marked phototropism of some species, particularly of the genus *Haemagogus*, which causes them to leave the deep parts of the valleys when the sun has passed over. The changes in humidity and atmospheric temperature that occur when the valleys pass into shadow are doubtless factors in the migration. Another observation that supported the hypothesis was that *Haemagogus* when in search of blood would follow man and animals for considerable distances over pasture land and secondary growth unsuitable for its long survival.

MANGABEIRA filho (O.) & GALINDO (P.). **The Genus *Flebotomus* in California.**—*Amer. J. Hyg.* **40** no. 2 pp. 182–194, 3 pls., 34 refs. Lancaster, Pa., 1944.

Detailed descriptions are given of both sexes of *Phlebotomus vexator*, Coq., from material collected in a sandy cave by a stream and in burrows of *Citellus beecheyi* in California in 1943, and of *P. stewarti*, sp. n., from adults of both sexes taken in the burrows of *C. beecheyi*, males from the cave and a female taken in 1938, also in California. The only species of the genus previously known to occur in the United States were *P. diabolicus*, Hall, and *P. texanus*, Dampf, both described from Texas [*R.A.E.*, B **24** 132; **27** 144], and *P. vexator*, described from Maryland and also found in Louisiana.

The American species of *Phlebotomus* of which the males have five spines on the distal segment of the upper clasper are divided into three groups, *viz.*, the subgenera *Brumptomyia* (as redefined by the senior author) and *Shannonomyia* and the *vexator* group. The diagnostic characters of these groups are given, with lists of the species of each and a key to the males of the third.

WATSON (R. B.) & RICE (M. E.). **Some epidemiological Characteristics of Malaria in North Alabama as determined by Data collected over the twenty-year Period 1923–1942.**—*Amer. J. Hyg.* **40** no. 2 pp. 199–208, 5 graphs, 4 refs. Lancaster, Pa., 1944.

A parasitological study of the annual prevalence of malaria in the Tennessee Valley in northern Alabama from 1923 to 1942 showed that the incidence of the disease was unusually high in 1923, 1929 and 1934; after 1934, the trend was progressively downward. From the accumulated data for these 20 years, its incidence is shown to rise between February and May and between July and October, when the maximum is reached. There is a rapid fall from October to February and a slight one from May to June. The minor rise is thought to reflect relapses of infections with *Plasmodium vivax*, the predominant parasite, acquired about seven months previously. The incidence of infection with *P. falciparum* rises from June to October and then falls until May. Seasonal prevalence in individual years conformed fairly closely to the cumulative data with certain notable exceptions. Information on the abundance of *Anopheles quadrimaculatus*, Say, was collected from 1935 onwards. An increase in its abundance was shown to be followed by rising malaria rates, the time of highest Anopheline population being followed in 30–60 days by the highest malaria rate for the year. There is considerable qualitative similarity between the curves for a given year. The downward trend in malaria incidence that set in in 1934 was most probably due in part to reduced populations of *A. quadrimaculatus* in certain fairly extensive areas. Many of the natural breeding places of this mosquito in the Tennessee Valley [*R.A.E.*, B **25** 186–187] have been inundated or drained since 1935. It was, nevertheless, produced in great abundance in certain areas during mid-summer, particularly in 1941 and 1942, yet malaria rates have declined rapidly since 1939 in the area in which it was most numerous. This is attributed largely to mosquito-proofing of houses [**29** 186; **30** 94, etc.].

HEADLEE (T. J.). **The Mosquitoes of New Jersey and their Control.**—$9\frac{1}{2} \times 6$ ins., x + 326 pp., 16 pls., 1 fldg. table, 1 map, 87 figs., 30 refs. New Brunswick, N.J., Rutgers Univ. Press, 1945. Price $4.00.

After brief introductory notes on the topography of New Jersey, the abundance of mosquitos there and the effectiveness of control measures taken in the past, and a list of 37 species occurring in the State, showing the popular and scientific names used for them in this book and in earlier publications, keys are given to the females and larvae of these species, and others for the identification of the adults and larvae of the commoner ones with a hand-lens. The

numbers of females of each of 31 species taken in each of 49 New Jersey light-traps [*R.A.E.*, B **31** 195, etc.] between 1932 and 1941, inclusive, are shown in a table.

The greater part of the book consists of a review of the individual species, most of which has been taken directly from the *Report of the New Jersey agricultural Experiment Station upon the Mosquitoes occurring within the State, their Habits, Life History, etc.*, published by J. B. Smith in 1904. The adult and larva of practically all the 37 species are described and illustrated and notes are given on the bionomics of each. Four other mosquitos have been identified in the State, but they are rare and of no great economic importance. They include *Anopheles atropos*, D. & K. The other Anophelines found are *A. punctipennis*, Say, *A. quadrimaculatus*, Say, *A. walkeri*, Theo., *A. barberi*, Coq., and *A. crucians*, Wied. The influence of temperature, the properties of water, food supply and natural enemies on mosquito development, the nature of the attraction of mosquitos to man and mosquito flight are discussed.

The history of mosquito control in New Jersey is then reviewed, the methods employed are described, the economic effect of reducing mosquito populations is discussed, and State laws relating to mosquito control are cited.

MATHESON (R.). **Handbook of the Mosquitoes of North America.**—2nd edn. (revd.), 9½×6 ins., viii+314 pp., frontis., 33 pls., 42 figs., 12 pp. refs. Ithaca, N.Y., Comstock Publ. Co., 1944. Price $4.00.

Considerable additional information has been included in this revised and enlarged edition of a book already noticed [*R.A.E.*, B **18** 68]. Most of this is in the systematic section, which comprises about two-thirds of the whole. So far as possible it contains descriptions of the females, male genitalia and larvae of the species of CULICINAE and *Megarhinus* that occur in America, north of Mexico, and brief accounts of their bionomics and distribution. Keys are given to the adults, pupae and larvae of the subfamilies of CULICIDAE, adults and larvae of the genera and adults of the species of CHAOBORINAE, adults, pupae and larvae of the tribes of CULICINAE, adults and larvae of the genera of CULICINI, males of the subgenera of *Aëdes* and adults, male genitalia and larvae of the species of *Anopheles*, *Aëdes*, *Culex*, *Culiseta*, *Psorophora*, *Mansonia*, *Deinocerites*, *Wyeomyia* and *Uranotaenia* and larvae of *Orthopodomyia*. The other section deals with the structure and biology of mosquitos in general, their relation to human welfare and their control, and methods of studying, collecting, rearing and preserving them. Some fresh illustrations have been added and also an extensive bibliography.

HARRISON (C. R.). **Control of Malaria in Mauritius.**—*Rev. agric. Maurice* **23** no. 4 pp. 133–145. [Port Louis] 1944.

The author gives an outline of his experience in the control of Anophelines and malaria in various countries in order to introduce a programme for their control in Mauritius. The four species of *Anopheles* occurring in the Island are *A. coustani*, Lav. (*mauritianus*, Grp.), which does not carry malaria, *A. maculipalpis*, Giles, which breeds in sunlit seepages and transmits malaria, but is not common enough to maintain it alone, and the two principal vectors, *A. gambiae*, Giles, which breeds in sunlit water, particularly puddles and rock pools, and *A. funestus*, Giles, which breeds in gently moving and lightly shaded water. As vectors breed in practically all kinds of water, species sanitation is not practicable in Mauritius. Control has to be directed against all mosquitos within one mile of dwellings. By this means, the number of gametocyte carriers and consequently the number of infected mosquitos on the Island should be reduced until there are too few vectors to infect man and too few gametocyte carriers to infect mosquitos. The control measures recommended to effect this are

discussed. They include oiling, draining, flushing, canalising rivers and streams and clearing edges, filling rock pools with concrete or having channels cut in them to allow the water to escape, the use of shade against *A. gambiae* and even against *A. funestus* if it is extremely dense [*cf.* *R.A.E.*, B **25** 180], and filling, draining or impounding swamps. Facilities are not available for making piped drains, but the abundant local stone can be used by filling the bottom of the drain with large rocks and covering the top with fine chips.

PARROT (L.) & GOUGIS (R.). **Notes sur les phlébotomes. XLI. Sur** *Phlebotomus roubaudi* **Newstead, 1913.**—*Arch. Inst. Pasteur Algérie* **22** no. 1 pp. 40–46, 3 figs., 13 refs. Algiers, 1944.

PARROT (L.) & MARTIN (R.). **XLII. Sur** *Phlebotomus larroussei* **var.** *canaaniticus*. —*T.c.* pp. 47–51, 3 figs., 9 refs.

PARROT (L.). **XLIII. A propos de** *Phlebotomus mascittii* **Grassi.**—*T.c.* pp. 52–54, 3 figs., 7 refs.

PARROT (L.) & MARTIN (R.). **XLIV. Phlébotomes de Djibouti.**—*T.c.* pp. 55–59, 2 figs., 9 refs.

PARROT (L.). & CLASTRIER (J.). **XLV. Présence de** *Phlebotomus perfiliewi* **en Tunisie.**—*T.c.* pp. 60–62, 18 refs.

A description of the female and a redescription of the male of *Phlebotomus roubaudi*, Newst., are given in the first paper from four adults collected in Maradi (Niger Colony) in 1943 [*R.A.E.*, B **32** 213], together with characters distinguishing them from those of *P. papatasii*, Scop., and *P. p. bergeroti*, Parrot, and a note on the divergent views of various authors as to the identity of *P. duboscqi*, Nev.-Lem. It is possible that *duboscqi* may prove to be an earlier name for either *bergeroti* or *roubaudi* or alternatively a synonym of *papatasii* [*cf.* **18** 129], but its identity cannot be decided without an examination of its type.

In the second paper, both sexes of *P. larroussei* var. *canaaniticus*, Adlr. & Thdr., are described from six individuals collected by artificial and day light in well lighted and humid situations in buildings near vegetation at Beyrout in 1943. The varietal status of this form is considered doubtful, as the females cannot be distinguished from those of *P. larroussei*, Lngn. & Nitzu., and only five males of the latter are known, but it appears to be distinctly domestic, unlike *P. larroussei*, and it certainly bites man.

On the basis of the characters of a co-type of *P. mascittii*, Grassi, redescribed by Newstead and of specimens collected in the type locality, Adler & Theodor concluded that *P. mascittii* is probably an earlier name for *P. perniciosus*, Newst. The author further discusses these characters in the third paper, however, and inclines to the view that it is *P. larroussei* and not *P. perniciosus* that is a synonym of *P. mascittii*.

It is recorded in the fourth paper that a large collection of *Phlebotomus* made at Jibuti (French Somaliland) between 1939 and 1942 comprised *P. subtilis*, Parrot & Martin, *P. clydei*, Sinton, *P. squamipleuris*, Newst., *P. papatasii* var. *bergeroti* and *P. cinctus*, sp. n., which is described from nine females. *P. subtilis* was the commonest and was abundant throughout the year in dark, damp, sheltered places near cultivation. An examination of the Somali examples of *P. clydei* made it evident that *P. vagus*, Parrot & Martin [**27** 234] is a synonym of it.

A list of the species of *Phlebotomus* hitherto known from Tunisia is given in the fifth paper, and *P. perfiliewi*, Parrot, is recorded there for the first time, 13 males having been found in the evening at light in September and October 1942.

GASCHEN (H.). **Les glossines de l'Afrique Occidentale Française.**—*Acta trop.* suppl. 2, [7+] 131 pp., 114 figs., 1 fldg. chart, 4 pp. refs. Basle, 1945.

This book was written to meet the need for a concise summary of present knowledge on *Glossina* in the French language. Brief introductory notes on the history of the discovery of the part played by flies of this genus in the transmission of trypanosomes are followed by accounts of the morphology and anatomy of the adults, the appearance of the larvae and pupae, and the systematic position of the genus, with a table showing how the various species and varieties are classified in subgenera or groups by Zumpt, Newstead and Austen. An illustrated key is given to the species known in French West Africa, followed by descriptions of the species occurring in west and central Africa, with information on their habitats, biology and distribution, and brief notes on the species that are confined to east Africa. The times when species of *Glossina* are active, their powers of flight, adaptation to high altitudes and various climatic conditions, their food preferences, the part they play in the transmission of sleeping sickness and trypanosomiasis of stock, the reservoirs of the trypansomes and the development of the trypanosomes in the fly are among the subjects discussed in the chapter on bionomics. Finally, information is given on measures for controlling and obtaining protection from *Glossina*, which include trapping adults, making their normal breeding places unsuitable, making clearings with a view to preventing contact between the fly and man, and taking measures of personal protection, and also on the technique of searching for adults and pupae, catching adults, and preserving, transporting and dissecting them. The text of Circular No. 1671/SSM–1 of 4th September 1939 of the Governor General defining the lines on which clearing is to be carried out in French West Africa and extracts concerning the same subject from an instruction of the Head of the General Autonomous Sleeping-sickness Service of French West Africa and Togoland are quoted in appendices. There are also a glossary and a bibliography.

PAPERS NOTICED BY TITLE ONLY.

[RUBTZOV (I. A.).] **Рубцов (И. А.). Two new Species of bloodsucking Flies (Simuliidae) from the Alaï Mountain Range** [Kirghizia]. [*In Russian and English.*]—*Probl. regional Parasitol.* **3** pp. 193–198, 1 fig. Moscow, 1939. [Recd. 1945.]

OSORNO-MESA (E.). **Two new Species of** *Haemagogus* **from Colombia,** *H. andinus* **and** *H. boshelli* **(Diptera : Culicidae).**—*Proc. ent. Soc. Wash.* **46** no. 7 pp. 165–175, 23 figs. Washington, D.C., 1944.

DICKINSON (W. E.). **The Mosquitoes of Wisconsin.**—*Bull. publ. Mus. Milwaukee* **8** no. 3 pp. 269–365, 1 col. pl., 32 figs., 57 refs. Milwaukee, Wis., 1944.

WOOD (S. F.). **An additional California Locality for** *Trypanosoma cruzi* **Chagas in the Western Cone-nosed Bug,** *Triatoma protracta* **(Uhler).**—*J. Parasit.* **30** no. 3 p. 199. Lancaster, Pa., 1944. [*Cf. R.A.E.*, B **33** 72.]

RILEY (W. A.). **The Occurrence of** *Amblyomma americanum* **in Minnesota and in Ohio.**—*J. Parasit.* **30** no. 3 pp. 200–201. Lancaster, Pa., 1944. [*Cf. R.A.E.*, B **33** 86.]

SNODGRASS (R. E.). **The feeding Apparatus of biting and sucking Insects affecting Man and Animals.**—*Smithson. misc. Coll.* **104** no. 7 (Publ. 3773) 113 pp., 39 figs., 6 pp. refs. Washington, D.C., 1944.

Annual Report for the Year 1943. The South African Institute for Medical Research, Johannesburg.—47 pp. Johannesburg [1944].

The section of this report dealing with entomology (pp. 20–23) includes a brief account of the progress of the flea survey of the Union of South Africa [*cf. R.A.E.*, B **31** 88]. *Desmodillus auricularis* and its commonest parasite, *Xenopsylla piriei*, Ingram, which are known to be associated with plague, occur in the south-west of Cape Province as far south as Elands Bay. Nearer the Cape Peninsula, however, the common rodent is *Tatera afra*, and *X. piriei* is replaced by *X. hirsuta*, Ingram, *X. lobengulae*, De Meillon, and *X. sulcata*, Ingram. These changes in the rodent and flea fauna probably account for the absence of plague from the Cape Peninsula.

Numerous outbreaks of dermatitis in various areas were all found to be caused by *Liponyssus bacoti*, Hirst, which is very common on rats in Johannesburg and is known to have caused dermatitis in South Africa since 1925 [**13** 100; **15** 92, 118]. Another species of *Liponyssus* easily confused with *L. bacoti* was also found on rats in Johannesburg. Eggs of *Ixodes rubicundus*, Neum., which is known to cause tick paralysis, were found to contain a toxin not differing in any way from that obtained from the eggs of three species of ticks that do not cause paralysis [**32** 18]. Larvae of *Musca domestica*, L., *Fannia scalaris*, F., *Sarcophaga* sp. and *Lucilia* sp. were identified from cases of intestinal myiasis during the year, and some 900 Phorids were bred from a stool passed under circumstances precluding all possibility of contamination and found to contain abundant small larvae.

The salinity of the lake at Port Elizabeth of which the salt content was raised to control breeding of *Chironomus* [**26** 94] has been kept high, and there has been no recurrence of the nuisance. Only two species of PHLEBOTOMINAE had been recorded from the Union until 1932, and the group was usually regarded as being rare and of little importance there. However, sporadic collecting has since shown that the sandflies have a wide distribution, and a species of the group of *Phlebotomus major*, Annan., which includes the vectors of disease in man, has been found in Southern Rhodesia. J. Muspratt found that a fungus of the genus *Coelomomyces* caused heavy mortality in mosquito larvae in nature in Northern Rhodesia. All attempts to infect larvae in the laboratory failed.

BULL (L. B.) & MULES (M. W.). **An Investigation of *Myxomatosis cuniculi* with special Reference to the possible Use of the Disease to control Rabbit Populations in Australia.**—*J. Coun. sci. industr. Res. Aust.* **17** no. 2 pp. 79–93, 2 refs. Melbourne, 1944.

In preliminary experiments carried out with a view to the use of myxomatosis to control rabbits in Australia, the virus was shown to be highly pathogenic for the European rabbit (*Oryctolagus* [*cuniculus*]) but did not harm any of a large number of other animals. It occurs in discharges from the eyes and nose and from lesions in the skin and appears to be transmitted normally by the respiratory route. The disease spread readily when the rabbits were forced to maintain close contact in a small enclosure. It was easy to exterminate a colony under these conditions, or maintain the disease indefinitely by introducing susceptible rabbits at short intervals. The virus can be introduced through injuries to the skin, and a method was devised of infecting rabbits by means of a trap that would wound and inoculate the animal but not retain it. Soil temperatures may, however, limit the use of this device, as the virus in suspensions of infective tissue will not withstand temperatures of 100°F. or more for long.

Other experiments showed that the disease is transmissible by *Echidnophaga myrmecobii*, Roths., and by mosquitos [*R.A.E.*, B **30** 31]. Wild rabbits in Australia are commonly infested with fleas of the genus *Echidnophaga* [**29** 110], especially during the warm months. It was found that *E. myrmecobii*

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would leave the carcass of a diseased rabbit up to 36 hours after death and often located and became attached to a new host, which developed myxomatosis in seven days. Fleas that had been feeding for 20 days and had infected their second host were still sufficiently active to transfer to and infect a third. Fleas voluntarily leaving a dead, infected host could infect a new one up to three days later, but fleas that were induced to detach did not carry infection to the new host. Larvae fed on flea faeces containing virus harboured it, but did not transmit the disease when they became adults. There is no evidence of cyclical development in the flea. *Aëdes aegypti*, L., readily transmitted the virus immediately after a feed on an infected rabbit and for about 14 days afterwards. Transmission was more certain at the first feed on a normal rabbit than later, but was sometimes effected at subsequent feeds. *A. alboannulatus*, Macq., *A. camptorhynchus*, Thoms., and *Culex fatigans*, Wied., transmitted infection under similar conditions, and though the result of one experiment with *A. notoscriptus*, Skuse, was negative, no significance can be attached to this.

In field experiments in which infected rabbits were put with hundreds of healthy ones in an enclosure 90 acres in extent and free from predatory animals and *Echidnophaga*, the disease exterminated some colonies but showed no tendency to spread from one colony to another and eventually died out. In a similar experiment in an enclosure of the same size in which the rabbits were infested with *Echidnophaga*, the disease spread to all warrens and the rabbit population of 500 was reduced to 17 in 60 days [**31** 31]. In field trials carried out over areas of from 300 acres to 7 sq. miles under completely natural conditions, including the presence of foxes and other predatory animals, distributing the disease with the help of the trap reduced populations when foxes were not present in appreciable numbers and when the rabbits were infested with *E. myrmecobii*, but in general no appreciable control was effected and the disease soon died out, probably on account of the early removal of sick rabbits by predators before secondary and tertiary cases could arise. It is concluded that myxomatosis cannot be used with any promise of success to control rabbits under most natural conditions in Australia. However, it might give temporary relief in localities with special conditions, including the presence of abundant insect vectors and the absence of predatory animals, if the rabbit population was only moderate and periodical re-introductions were made.

HENRY (M.). **Stickfast Flea of Poultry, Outbreak at Broken Hill.**—*Agric. Gaz. N.S.W.* **55** pt. 7 p. 320. Sydney, 1944.

An outbreak of the stickfast flea of poultry [*Echidnophaga gallinacea*, Westw.], which has not previously been recorded from New South Wales [*cf. R.A.E.*, B **27** 205], has occurred at Broken Hill in the western part of the State. The flea has almost certainly been introduced from South Australia [*cf. loc. cit.*]. It has been present in Western Australia for many years and has also been found in Queensland [**31** 122].

[CHERKASSKIĬ (E. S.).] **Черкасский (Е. С.). The Treatment and Prevention of Sheep Scab and Haemosporidia of domestic Animals by Means of Pyrethrum Preparations.** [*In Russian.*]—*Veterinariya* **22** no. 1 pp. 24–27. Moscow, 1945.

The experiments described were carried out in Russia in 1941 and 1944, and the forms of pyrethrum used were a dust of pyrethrum powder containing 0·3 per cent. pyrethrins I and II, aqueous suspensions of this dust, and aqueous emulsions of a preparation of pyrethrum extract and soap.

In laboratory tests, larvae, nymphs and adults of *Psoroptes ovis*, Hering, taken in skin scrapings from sheep and adult ticks of the genera *Boophilus*, *Dermacentor*, *Hyalomma* and *Rhipicephalus* were dusted or sprayed in petri

dishes and transferred after three minutes to a chamber with a constant temperature of 37°C. [98·6°F.]. The mites were examined at intervals for 15–20 days, and the ticks for 40 days. When sprayed with the emulsion or suspension, both diluted to contain 0·002 per cent. pyrethrins, some of the mites died in an hour and all within a week, and some ticks died in one day and all within 20 days. Sprays containing 0·001 per cent. pyrethrins were ineffective ; those containing 0·01 per cent. or less allowed some of the ticks to oviposit, but the eggs did not hatch. Dusting killed all mites and some ticks in three days and all ticks in 13 days. Most of the ticks died within three days when they were sprayed with very dilute flour paste before being dusted. Increasing the concentration of pyrethrins to 0·02 per cent. and the exposure to five minutes did not appreciably increase the effectiveness of the sprays. Female ticks and mites were more resistant than males, and the fully fed females more so than others.

In experiments under farm conditions, sheep heavily infested by *P. ovis* were freed from the mites and their eggs by washing the affected parts with the emulsion or suspension at a temperature of 19°C. [66·2°F.] and a rate of 1·1 gals. per animal ; the lowest effective concentrations of pyrethrins were 0·002 per cent. for the emulsion and 0·004 per cent. for the suspension. Dusting killed all the mites only if the sheep were first sprayed with dilute flour paste. Complete control of *P. ovis* in a flock of nearly 7,000 sheep was obtained by dipping each animal for 15–20 seconds (including the head for 1–2 seconds) in a suspension containing 0·01 per cent. pyrethrins, or an emulsion containing 0·006 per cent., both at 18–19°C. [64·4-66·2°F.]. The more severely affected sheep had been washed with an emulsion or suspension containing 0·02 per cent. pyrethrins 3–4 days before the dip. No living mites were detected in skin scrapings for a month after dipping, except in the case of a few sheep that had not been given the preliminary wash ; these were dipped again, and complete mortality of the mite was obtained.

When cows infested with *Boophilus, Rhipicephatus* and *Hyalomma* were each dusted with 65 gm. pyrethrum powder, 50 per cent. of the ticks dropped from them in 24 hours, without becoming fully engorged [*cf. R.A.E.*, B **30** 142], and the others did so in the course of a week. Reinfestation did not begin until eight days after the treatment. In the case of other cows that were infested with these ticks and *Haemaphysalis cinnabarina punctata*, C. & F., and *Ixodes ricinus*, L., all the ticks dropped in 3–4 days when the animals were sprayed with dilute paste and then dusted at a rate of about 85 gm. per cow, but reinfestation began on the sixth day after heavy rain had washed off the dust. Complete control of *Hyalomma, Rhipicephalus* and *Boophilus* was obtained in a herd of cattle by spraying the animals with dilute paste and then dusting them in groups of 60–80 in a closed shed. They were kept in the shed for 20–30 minutes after the dust was released and it was applied at a rate equivalent to 78 gm. per animal. All the ticks dropped within four days and reinfestation did not occur for ten days. Washing one-year-old bullocks with a suspension containing 0·01 per cent. pyrethrins at the rate of 1·1 gals. per animal completely freed them from ticks and destroyed the louse, *Haematopinus eurysternus*, Nitzsch, and its eggs.

Pyrethrum dust applied at the rate of 65 gm. to each of two horses infested with *Dermacentor* spp. caused 90 per cent. of the ticks to drop off unengorged in eight days, during which time there was no reinfestation.

PRILL (E. A.), HARTZELL (A.) & ARTHUR (J. M.). **Insecticidal Activity of some Alkoxy Analogs of DDT.**—*Science* **101** no. 2627 pp. 464–465, 7 refs. Lancaster, Pa., 1945.

In comparative tests of 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane (DDT) and several synthetic alkoxy analogues of it against *Musca domestica*, L.,

by the Peet-Grady method, a solution of 2·5 gm. DDT per litre of a refined petroleum distillate gave 42 per cent. knock-down in ten minutes and 38 per cent. kill in 24 hours, the methoxy analogue, 2, 2-di-para-anisyl-1, 1, 1-trichlorethane, gave 91, 99 and 99 per cent. knockdown and 31, 32 and 85 per cent. kill at concentrations of 1·5, 2 and 4 gm. per litre, and the ethoxy analogue, 2, 2-di-paraphenetyl-1, 1, 1-trichlorethane, gave 90 per cent. knock-down and 86 per cent. kill at 2 gm. per litre. The mortality of the flies that were not knocked down in ten minutes was not determined. With the addition to the sprays of 5 gm. pyrethrins per litre to increase knock-down, 1 and 1·5 gm. paraphenetyltrichlorethane gave 97 and 99 per cent. knock-down and 78 and 91 per cent. kill, and 1 gm. DDT gave 96 per cent. knock-down and 86 per cent. kill ; with the addition of 1·5 gm. of the methoxy analogue for the same purpose, 1 gm. DDT and 1·5 gm. of the ethoxy analogue gave 94 and 97 per cent. knock-down and 86 and 88 per cent. kill, respectively. The *n*-propoxy analogue showed little toxicity and the *n*-butoxy analogue practically none.

DDT and its methoxy and ethoxy analogues were about equally effective against the larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), concentrations of 0·03–0·04 parts per million in tap water killing half the larvae in 20 hours ; the *n*-propoxy analogue gave about 50 per cent. kill at 0·4 p.p.m. and the *n*-butoxy analogue negligible kill at 4 p.p.m.

Preliminary feeding tests on white rats indicated that the ethoxy analogue may be less toxic than DDT to the higher animals.

LEPIGRE (A. L.). **Les nouvelles méthodes insecticides et les épidémies.**—14 pp. Algiers, Cent. nat. Rech. sci., 1944.

The principal fumigants employed against pests of agricultural crops and stored products are briefly reviewed to introduce a discussion on their use for the control of insects of medical importance, notably *Pediculus humanus*, L., and fleas during epidemics of typhus and plague. It is concluded that the only fumigants suitable for this purpose are ethylene oxide which is scarce, methyl bromide, and in certain circumstances hydrocyanic acid gas, which requires special precautions on account of its toxicity and retention by the matter treated and is considered quite unsuitable for freeing clothing from lice. The first two have a delayed action against insects, but experiments have shown that lice that have been exposed to a lethal dose do not feed. Ways in which equipment and methods designed for the fumigation of stored products can be adapted to the various conditions under which fumigation against insects of medical importance is required are considered with particular reference to Algeria.

HOPKINS (G. H. E.). **Notes on Myiasis, especially in Uganda.**—*E. Afr. med. J.* **21** no. 9 pp. 258–265, 16 refs. Nairobi, 1944.

The author discusses the categories into which the various forms of myiasis can be divided, and briefly reviews records of myiasis, chiefly in man in various parts of Africa, caused by flies, other than Oestrids, that occur in Uganda. In addition to *Cordylobia anthropophaga*, Grünb., the flies known to have infested man in Uganda are *Lucilia cuprina*, Wied., *Chrysomyia inclinata*, Wlk., and *C. bezziana*, Villen. There are six records of *L. cuprina*, all from wounds or burn lesions, one of *C. inclinata*, from the subcutaneous tissue in burns, and three of *C. bezziana*, Villen., from the nose, a festering orbit and an ulcer.

HENRARD (C.), van WYMEERSCH (H.) & WANSON (M.). **Description de la larve et de la nymphe de l'*Anopheles dureni* Edw.**—*E. Afr. med. J.* **21** no. 9 pp. 266–269, 1 pl. Nairobi, 1944.

The fourth-instar larva and pupa of *Anopheles dureni*, Edw. [*cf. R.A.E.*, B **26** 182] are described from material collected at the edges of clear, slowly-

flowing, sandy-bottomed streams shaded by heavy vegetation at Muela in the Kwango district of the Belgian Congo. Large numbers of larvae were taken. Characters are given for distinguishing the larva from that of *A. cinctus*, Newst. & Carter [*cf.* **31** 88].

WANSON (M.). **Elevage du** *Taeniorhynchus* (*Coquillectidia*) [*Coquillettidia*] *metallicus* **Theobald.**—*E. Afr. med. J.* **21** no. 9 pp. 269–272, 273, 1 pl. Nairobi, 1944.

The mosquitos of the subgenus *Coquillettidia* of *Mansonia* (*Taeniorhynchus*), unlike those of the subgenus *Mansonioides*, lay their eggs on the surface of the water. The eggs form characteristic rafts, which in the case of *M.* (*C.*) *metallica*, Theo., are hexagonal and consist of some 200 eggs. The larvae, like others of the genus, attach themselves to the stems or roots of aquatic plants, and are difficult to rear because they will die on decaying vegetation rather than transfer themselves to fresh roots and cannot develop at the surface of the water, though they can survive there for some time. Having discovered that larvae of all instars attached themselves readily to strips of thick, coarse wrapping paper fastened to the rim of the breeding jar and hanging into the water, and that they could moult and complete their development on it, the authors reared in this manner larvae collected in abundance in Stanley Pool and were thus able to identify them as *M. metallica*. The larva of this species was hitherto unknown. Its distinguishing characters are given. To ensure complete development from egg to adult, it is essential to supply the young larvae with suitable food, water and light, but with diffused light it is possible to rear fourth-instar larvae to the adult stage in river water without extra food. Unlike the larvae, the pupae remain fixed throughout the stage and die if they become detached. If the exchange of air from the submerged to the unsubmerged part of the paper is stopped by impregnating the paper at the level of the water surface with paraffin wax, the larvae can no longer breathe and remain attached for a short time only.

WANSON (M.) & BERTEAUX (M.). **Note sur l'infectivité de l'***Anopheles* (*Neocellia*) *brunnipes* **Theobald.**—*E. Afr. med. J.* **21** no. 9 pp. 272–273, 4 refs. Nairobi, 1944.

Anopheles brunnipes, Theo., was described from Léopoldville in 1904 and not identified again from the Belgian Congo until recently. It has been found in the past few years in Mozambique [*R.A.E.*, B **29** 201], Sierra Leone [**30** 86] and the French Cameroons. Careful search in 1940 and 1941 failed to reveal its presence in Léopoldville, but 112 females containing human blood and three males were found in native dwellings there in 1942 and nine adults were taken in 1943, all in the cold, dry season (May–August). Four gland and two gut infections with malaria parasites were found in 102 females dissected. The oöcysts appeared to be those of *Plasmodium falciparum*. The importance of *A. brunnipes* as a vector of malaria is not considered great in view of its scarcity and its seasonal distribution. Its breeding places in Léopoldville are unknown.

CORRÊA (R. R.) & [DA] S[ILVA] RAMOS (A.). **Notas sôbre o estudo da biologia do** *A. tarsimaculatus* **em Caraguatatuba.** [Notes on the Study of the Biology of *A. tarsimaculatus* in Caraguatatuba.]—*Arq. Hig. Saúde públ.* **9** no. 20 pp. 103–108, 4 refs. São Paulo, 1944. (With a Summary in English.)

In view of the finding of malaria parasites in females of *Anopheles emilianus*, Komp (for which the authors use the name *tarsimaculatus*, Goeldi [*cf. R.A.E.*, B **32** 91]) from houses in Caraguatatuba on the coast of São Paulo, in 1943, a study of the bionomics of the larvae and adults of this Anopheline was begun. An account is here given of the methods used.

Corrêa (R. R.) & [da] S[ilva] Ramos (A.). **Contribuição ao conhecimento da distribuição geográfica dos anofelinos do Estado de São Paulo (Brasil) (Diptera, Culicidae).** [Contribution to the Knowledge of the geographical Distribution of the Anophelines of the State of São Paulo, Brazil.]—*Arq. Hig. Saúde públ.* **9** no. 20 pp. 125–151, 26 refs. São Paulo, 1944. (With a Summary in English.)

Lists, based mainly on material collected during 1934–43 by the Service of Malaria Prophylaxis of the Health Department of the State of São Paulo, are given of the Anophelines found in the State, with notes on their local distribution, and of the municipalities and their subdivisions, showing the species of Anophelines that occur in them.

Rozeboom (L. E.) & Hess (A. D.). **The Relation of the Intersection Line to the Production of** *Anopheles quadrimaculatus*.—*J. nat. Malar. Soc.* **3** no. 3 pp. 169–179, 2 figs., 4 refs. Tallahassee, Fla., 1944.

The data given in this paper were collected in June and July 1943 in the section of the Tennessee Valley in northern Alabama during studies designed to determine the relation of the intersection value [*R.A.E.*, B **32** 210] to the production of *Anopheles quadrimaculatus*, Say, in representative types of aquatic and semi-aquatic vegetation in the reservoirs of the Valley. The plants studied comprised four species of the grass type and one each of the submerged, leafy emergent, naked emergent and floating-leaved types. The sampling methods and statistical technique used are described.

It is concluded from the results obtained that in the case of individual species of plants there is a close positive correlation between the density of eggs and larvae of *A. quadrimaculatus* and the intersection value, and that the increased production that accompanies high intersection values is probably due to the combined effect of increased oviposition and decreased larval mortality. The only exception to this correlation was in dense stands of *Eleocharis quadrangulata*, a naked-stemmed emergent plant, which probably presented a mechanical barrier to oviposition [*cf.* **31** 62]. The results also indicated that, with the same exception, the relative numbers of *A. quadrimaculatus* produced among different species of plants was in direct proportion to their relative intersection values, other factors remaining equal. It is believed that this confirmation of the intersection-line theory will facilitate the comprehension and application of water-level management and other measures used by the Tennessee Valley Authority for the control of Anophelines in its impounded waters.

Hess (A. D.) & Kiker (C. C.). **Water Level Management for Malaria Control on impounded Waters.**—*J. nat. Malar. Soc.* **3** no. 3 pp. 181–196, 4 figs., 6 refs. Tallahassee, Fla., 1944.

The use of water-level management on the reservoirs of the Tennessee Valley Authority for the control of *Anopheles quadrimaculatus*, Say, the local vector of malaria [*R.A.E.*, B **24** 130–131], is reviewed, with particular reference to developments that have taken place since 1940. Seasonal recession alone, cyclical fluctuation alone and a combined programme are used on the Authority's reservoirs, the last being employed on the nine main river reservoirs, in which water-level management for Anopheline control is most difficult because of the variety of factors that must be considered. These include navigation, flood control and the generation of hydro-electric power. A system has been developed that conforms as closely as possible to the normal operation systems of the reservoirs. It incorporates the following four successive phases: early spring flood surcharge, followed by a reduction to the normal summer maximum level, which results in the stranding of the winter accumulations of drift and flotage; the maintenance of a relatively constant pool level at the normal

maximum summer elevation from the beginning of the period of early spring growth until production of *A. quadrimaculatus* becomes moderate, so that marginal vegetation is prevented from developing in the zone of fluctuation ; weekly cyclical fluctuation from the beginning of moderate production until the beginning of heavy production of *A. quadrimaculatus* to eliminate the intersection line [see preceding abstract] periodically ; and seasonal recession of about 0·1 ft. per week combined with cyclical fluctuation until breeding finishes. No special requests for controlled water levels are made during winter. The first two phases are thus purely prophylactic, in that they limit or prevent the development of suitable breeding conditions later in the season, and the third and fourth are not only prophylactic, in that they limit the encroachment of marginal plants, but also act directly against the mosquitos by changing their micro-habitat, stranding eggs and larvae and exposing the larvae to natural enemies. The effects of water-level management are cumulative, a proper seasonal system killing many semi-aquatic plants and stumps and resulting in improved shoreline conditions for the following season. The advantage in effectiveness and cost of the improved system is illustrated by data for two reservoirs for 1942, when the water level fell during the spring growth period, and 1943, when the new system with constant pool level during the growth period and limited recession was adopted.

Because of the considerable fall in level during the summer and autumn (20–50 ft. or more), seasonal recession without cyclical fluctuation usually keeps the shoreline of storage reservoirs in tributary streams well below the encroaching marginal vegetation and thus effects satisfactory control. These reservoirs allow of better regulation of the downstream reservoirs where malaria is more serious. The chief difficulty in dealing with them is experienced when unseasonal rains necessitate the restoration of high water levels during the breeding season, particularly if a spring drought has made it impossible to fill the reservoir during the spring growth period and marginal vegetation has encroached. It is intended to use a seasonal recession of 5 ft. without cyclical fluctuation on the new Kentucky main river reservoir, which will be too large for cyclical fluctuation to be practicable. Cyclical fluctuations of 1½–2 ft. obtained in connection with the normal operation of the reservoir and without seasonal recession gave satisfactory control during 1943 on Wilson Reservoir, which has the highest generating capacity and lowest storage capacity of all the main river reservoirs.

KRUSE (C. W.), HESS (A. D.) & METCALF (R. L.). **Airplane Dusting for the Control of *Anopheles quadrimaculatus* on impounded Waters.**—*J. nat. Malar. Soc.* **3** no. 3 pp. 197–209, 4 figs., 4 refs. Tallahassee, Fla., 1944.

The following is mainly based on the authors' summary of this account of the major improvements that have been made since 1938 in the technique of applying dusts from aeroplanes for the control of larvae of *Anopheles quadrimaculatus*, Say, on the reservoirs of the Tennessee Valley Authority [*cf. R.A.E.*, B **25** 117 ; **26** 132]. The aircraft, dust hopper, agitators, release valve, venturi and other special equipment are described, the type and situation of loading strips and the training of pilots are briefly discussed, and the methods of calibrating the rates of discharge and mixing and labelling the dust are explained. Dusting is carried out during the calm period of early morning, usually from a height of 20–30 ft. The standard dust consists of 22·2 per cent. Paris green by weight in soapstone.

Dust distribution was determined by particle counts until 1940 and by quantitative chemical analysis after that time. The distribution curves obtained by the two methods were similar. They were noticeably skewed to the left, probably because of the torque of the plane propellor. It appears that about

28 per cent. of the Paris green released falls in a swath 200 ft. wide and over 20 per cent. in the central 100 ft. of the swath, while over 70 per cent. drifts away from the treatment area and for practical purposes is lost. On the basis of available data, it is estimated that actual recoveries of 0·2, 0·6 and 1·2 lb. Paris green per acre are required to give a 90 per cent. kill of larvae, and half as much to give 70 per cent. kill, where the plant cover is light (0·35 per cent.), medium (35–65 per cent.) and heavy (65–100 per cent.), respectively. A chart prepared from these data shows the widths of the strip over which 70 and 90 per cent. kills of larvae will be effected with light, medium or heavy plant cover at varying rates of discharge and distances between flights. Studies on ingestibility, toxicity and distribution indicated that Paris green for application from aircraft should be of a larger particle size than the ordinary commercially available material, and a tentative revision is suggested of the particle size specifications desirable in Paris green intended for this purpose. It is thought that a Paris green meeting these specifications can be produced commercially without materially increasing cost.

Bishop (E. L.) & Gartrell (F. E.). **Permanent Works for the Control of Anophelines on impounded Waters. (A preliminary Report with particular Reference to the Kentucky Reservoir of the Tennessee Valley Authority.)**—*J. nat. Malar. Soc.* **3** no. 3 pp. 211–219, 2 maps. Tallahassee, Fla., 1944.

Topography, fauna, flora, climate and the many purposes served by the reservoirs constructed in the Tennessee Valley in the past decade [*R.A.E.*, B **24** 130–131] have combined to produce problems unprecedented in the south-eastern United States in the control of *Anopheles quadrimaculatus*, Say. The Kentucky Reservoir, with which the Tennessee Valley Authority was to complete its major construction programme for the development of the Tennessee River in 1944, was expected to cause particular difficulty because an environment highly favourable to the production of the Anopheline in very large numbers was sure to be formed in the middle reaches where the area to be inundated was a broad, flat alluvial plain. In earlier work, the usual anti-larval measures had proved costly and not entirely effective in spite of improved methods, and mosquito-proofing of houses had to be adopted [**30** 73, 94]. This checked transmission, but satisfactory control of *A. quadrimaculatus* was not obtained. It was decided that in the large new Kentucky reservoir, where there were definite limits to the possibilities of favourable water level management [*cf.* **33** 122] and unusual complications to drainage maintenance associated with the sand and silt carried by tributary streams and agricultural drainage, an attempt should be made to incorporate permanent control facilities in the original construction. Study of the problem began in 1938, and later a report was prepared proposing a programme including diking of the largest flat areas and removal of the water from them, combined deepening and filling of smaller shallow areas and those that did not lend themselves to the first method, restriction of the use of land within one mile of the lake to daytime occupancy (a measure suited to areas where the value of the land is low and the population sparse), marginal drainage, and mosquito-proofing of houses in limited areas until more permanent solutions could be found when the pool was filled, and also limited use of larvicides and shoreline maintenance. The recommendations were approved in principle in 1941, and the malaria control facilities incorporated in the construction programme. Through co-ordination of malaria control plans with the general plan for the reservoir, it was possible to effect a certain saving in the capital expenditure needed for permanent shoreline improvement, and the annual cost of the proposed programme is shown to be less than half that of control by the conventional means of shoreline maintenance and the application of larvicides.

Twinn (C. R.). *Anopheles* **Mosquito Survey in Canada.**—*Contr. Div. Ent. Dep. Agric. Can.* no. 11 (multilith), [1+]13 pp., 14 figs. Ottawa, 1944.

Because of the fear that malaria transmission may occur in Canada as a result of the presence of prisoners of war and members of the armed forces coming from areas where the disease is prevalent, brief notes are given on the distribution in the Dominion of the Anophelines now known to occur there, which comprise *Anopheles maculipennis* vars. *occidentalis*, D. & K., and *freeborni*, Aitken, *A. punctipennis*, Say, *A. quadrimaculatus*, Say, and *A. walkeri*, Theo., together with a key to the females, indications of the differences in appearance, life history and habits of Anophelines and *Aëdes*, and instructions on where to look for Anophelines and how to collect them, including a description of the New Jersey suction light-trap [*R.A.E.*, B **31** 195, etc.].

Vargas (L.). **Simúlidos del nuevo mundo.**—*Monogr. Inst. Salub. Enferm. trop.* no. 1, vii+241 pp., 10 pls., 16 pp. refs. Mexico, D.F., 1945.

The first section of this book consists of accounts of the morphology and anatomy of adult Simuliids and the morphology of the larvae and pupae, and discussions of the life-history and habits of the members of this family, their economic importance, parasites and predators and methods of rearing them.

The first part of the second or systematic section contains a summary of divergent views as to the classification of the family and a list of the subfamilies, tribes, genera and subgenera that have been proposed in it, showing the views of various workers as to their status. The author adopts the classification of Edwards [*R.A.E.*, B **20** 14], in which only two genera and seven subgenera are recognised. Among the genera not included in Edwards' work are *Danubiosimilium* and *Echinosimulium* [**26** 214], which are considered to come within the scope of the subgenus *Simulium*. The second part of this section is a catalogue of the New World species, showing their distribution and synonymy, followed by lists of the species arranged by countries.

Soberón y Parra (G.) & León y Blanco (F.). **Las moscas del género** *Hippelates* **como posibles vectores del mal del pinto (2a. comunicacion).**—*Ciencia* **4** no. 11–12 pp. 299–300, 2 refs. Mexico, D.F., 1944.

The authors refer to experiments in Mexico described in a paper that has not been received at this Institute (F. León y Blanco & G. Soberón y Parra. Nota sobre la transmisión experimental del mal del pinto por medio de una mosca del género *Hippelates*.—*Gac. méd. Méx.* **71** pp. 534–539, 1941) in which they showed that the disease known as mal del pinto [or carate] could be transmitted by flies of the genus *Hippelates*. An account is given in the present paper of investigations on the persistence of the spirochaetes [*Spirochaeta caratea* (*R.A.E.*, B **32** 125, etc.)] in flies of this genus that had fed on serum from an opened lesion on an infected person. Mobile spirochaetes were present in all cases in serum from the digestive tract of the flies 10–30 minutes after an infective meal, spirochaetes were in all cases present but some had lost their mobility 40–70 minutes after the meal, and fewer could be seen and most were motionless after 80–120 minutes. Only very occasional motionless spirochaetes were seen when more than two hours had elapsed. There were spirochaetes in three out of 11 specimens of vomit drops, each from 4–10 flies, collected 15–20 minutes after an infective meal and examined immediately. No spirochaetes were found in the contents of the digestive tract of 31 adult *Hippelates* taken in nature.

PELÁEZ (D.). **Algunas notas sobre el hallazgo en México de un microhimenóptero parásito de huevos de** *Triatoma pallidipennis* **(Stål).** [Notes on the Finding in Mexico of a Hymenopterous Parasite of the Eggs of *T. pallidipennis*.]—*Ciencia* **5** no. 1–3 pp. 29–33, 3 graphs, 2 refs. Mexico, D.F., 1944.

At the end of March 1942, the author received a consignment of adults of *Triatoma pallidipennis*, Stål, taken in the State of Michoacán, Mexico, and also 570 eggs. Most of the eggs had been laid in the box between the 27th and 29th March, but a few had been collected with the bugs. They were put aside in two jars and kept at laboratory temperature (20°C. [68°F.]). On 7th April, eight females and one male of *Telenomus fariai*, Costa Lima, a Scelionid previously known as an egg-parasite of *Panstrongylus* (*Triatoma*) *megistus*, Burm., in Brazil [*R.A.E.*, B **15** 235 ; **17** 53] were observed in one of the jars. Examination showed that only one of the 300 eggs in the jar was empty. It had a circular orifice at the end opposite to the operculum.

The parasites were kept in the jar and fed on honey and water. Two females were observed to oviposit on 7th April, and the last died after a fortnight, by which time at least 78 eggs of *Triatoma* had been parasitised. Of these, 50 were kept in individual containers and 12 others were put together in one. The first adults of the second generation emerged on 20th June, after a development period that was much longer than that previously recorded [**17** 53]. From 20th to 23rd June, 433 adults of *Telenomus fariai* emerged from 47 isolated parasitised eggs, the larvae in the other three dying. The 12 eggs kept together gave rise to 116 adults. An average of 0·98 male and 8·32 females was obtained per egg. No isolated egg gave rise to males only, and all the males obtained were smaller than the females, which might indicate that they were diploid [but *cf.* **32** 104]. Parasitism in nature appears to be rare, but the finding of natural parasitism in two species of Triatomids and the fact that da Costa Lima obtained parasitism of a third in the laboratory [**17** 53] make it appear that *Telenomus fariai* is not highly specific. The possibility of using it for the control of *Triatoma* in Mexico is discussed.

WARD (R.), MELNICK (J. L.) & HORSTMANN (D. M.). **Poliomyelitis Virus in Fly-contaminated Food collected at an Epidemic.**—*Science* **101** no. 2628 pp. 491–493, 2 figs., 17 refs. Lancaster, Pa., 1945.

Much evidence has been obtained of recent years suggesting that the virus of poliomyelitis may enter the human body through the mouth and alimentary tract. The virus has repeatedly been demonstrated in human faeces, in sewage and in flies [*cf.* *R.A.E.*, B **33** 109, etc.], but there is no proof that food contaminated by flies is infective when ingested.

During an epidemic in North Carolina in June 1944, plates of food (slices of banana sprinkled with sugar and water) and fly-traps containing banana and sugar with liver or fish were exposed for 24–48 hours in or about the houses of patients within a week of the onset of illness. After exposure, both bait and food showed evidence of gross contamination by flies, and they were subsequently fed separately for several days to two isolated young chimpanzees. Excreta from these animals were shown by intracerebral inoculation into rhesus monkeys [*Macaca mulatta*] to be free from poliomyelitis virus before the meals were begun, but to contain it on 4 and 3 occasions, respectively, afterwards. Both chimpanzees showed a rise in temperature without evidence of paralytic poliomyelitis, and since the excreta were infected not only immediately after the infective meals but also 3–14 days later in one case and 20 days in the other, it is considered that they acquired subclinical infections and that the virus

multiplied in them. Of 428 flies taken in the traps and identified, 349 were *Musca domestica*, L., 26 were *Fannia* sp., and most of the others were blowflies.

BROWN (J. H.). **Sylvatic Plague : a Note on the finding of large Numbers of Fleas on Ground Squirrels (Gophers) in Alberta.**—*Bull. Brooklyn ent. Soc.* **39** no. 3 pp. 80–82, 1 ref. Lancaster, Pa., 1944.

Observations made in connection with the sylvatic plague survey in Alberta [*R.A.E.*, B **32** 9, 186], where infection in *Citellus richardsoni* was first demonstrated in 1939 and was subsequently found to occur in epizootic form over an area of 2,000 sq. miles in the south-east and to be present on another of at least 36 sq. miles further south, showed a definite relationship between epizootic plague in the ground-squirrels and the average number of fleas they carried. However, this relationship is affected by many factors, such as the density of the ground-squirrel population, the presence or absence of predatory and scavenger birds, and the carrying out of control operations. When all these factors are known, it should be possible to calculate a " critical flea-index " that can be applied to any area to determine the presence or absence of plague in *C. richardsoni* there. This index was tentatively estimated as 2, and a fair measure of success attended its use in the field in 1941 and 1942, but the figure will have to be revised as more information is obtained. The rise of the flea-index to or above the critical figure during a plague epizootic is due to transfer of fleas to surviving hosts from those that die on the surface of the ground. Their chance of transfer is increased by the habits of *C. richardsoni*, which does not live in colonies, but is widely scattered and moves extensively over the prairie. From a comparison of the results of examination of 6,264 individuals shot during 1938–42 with those reported for California by Eskey & Haas in a paper already noticed [**30** 128], it was estimated that the normal flea-index for *C. richardsoni* is about 1·7. Data are given on certain individuals that bore exceptionally large numbers of fleas. All were taken in areas in which the occurrence of plague was known or suspected.

Citellus columbianus, which is common in the mountain and foothill regions of Alberta, lives in colonies and has a restricted range. Plague has not been found in it in Alberta. The average number of fleas per host on 508 individuals shot or trapped during 1938–42 was 2·54, with very little variation in the number taken from individual animals. The average found by Eskey & Haas was 2·2.

AUGUSTSON (G. F.). **The Flea Genus *Thrassis* and Sylvatic Plague, with the Description of *T. brennani* n. sp.**—*J. Parasit.* **30** no. 4 pp. 237–240, 3 figs., 4 refs. Lancaster, Pa., 1944.

Studies of the fleas of native rodents in the far western United States and the incidence of sylvatic plague there have shown that species of *Thrassis* [a genus that comes within the scope of *Ceratophyllus*, sens. lat.] are far more numerous on the rodents than those of any other. In a paper already noticed [*R.A.E.*, B **28** 26], Eskey & Haas reported experimental transmission of native rodent plague by some species of *Thrassis* and it is thought probable that members of the genus can be closely associated with the occurrence of plague among native rodents. The fact that they can withstand periods off the host would make them particularly good vectors. A list is given of the known species of *Thrassis*, showing their usual hosts, and both sexes of *T. brennani*, sp. n., are described from *Citellus tridecimlineatus texensis* in Texas. Apart from *T. princei*, Hubbard [described from Kansas], this is the only species known to occur east of the Rocky Mountains. According to the literature, sylvatic plague has so far been observed only in the far western areas. The author has never been attacked by any *Thrassis* nor are there any certain records that other workers have.

James (M. T.). **Two erroneous Records in American Literature of the causative Agents of Myiasis.**—*J. Parasit.* **30** no. 4 pp. 273–274. Lancaster, Pa., 1944.

In 1907, Blankmeyer reported a severe case of intestinal myiasis caused by *Fannia* (*Anthomyia*) *canicularis*, L. In 1914, he stated that his previous determination was incorrect and that the larvae in question were *Anthomyia pluvialis*, L. Except for one from Europe that needs re-examination [*cf. R.A.E.*, B **3** 31, 152], this is the only record known to the author of *A. pluvialis* producing myiasis in man, and the drawing in Blankmeyer's first paper indicates clearly that he was dealing with a species of *Fannia*, certainly not *F. canicularis*, but possibly *F. scalaris*, F.

The record by E. P. Felt of the removal of several larvae of *Wohlfahrtia vigil*, Wlk., from a cyst in the eye of a man in New York State [**12** 189; **14** 209] was unusual, as *W. vigil* is known to attack only subcutaneous tissues in very young animals and children. It had not been reported in ocular myiasis or in adults. However, a photograph of the larva in a subsequent paper clearly shows it to be *Oestrus ovis*, L., which has frequently been recorded as producing conjunctivitis in man.

Rozeboom (L. E.). *Phlebotomus limai* **Fonseca in the United States (Diptera : Psychodidae).**—*J. Parasit.* **30** no. 4 pp. 274–275. Lancaster, Pa., 1944.

A species of *Phlebotomus* collected from a hollow tree in northern Alabama is considered to be *P. limai*, Fonseca, in spite of a few morphological differences. A comparison is given of measurements of adults of both sexes from Alabama with those of adults from Brazil, the only country from which this sandfly had been previously recorded. The same species was subsequently identified in museum collections from Alabama, Mississippi and North Carolina. Some of the females had been taken while biting. Specimens from Venezuela have also been tentatively identified as *P. limai*.

A list is given of the other species of *Phlebotomus* known to occur in the United States [*R.A.E.*, B **33** 113].

Annand (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 19**[42–]**43.**—58 pp. Washington, D.C., U.S. Dep. Agric., 1944.

Much of the work dealt with in this report concerns the modification of insect control measures in view of the scarcity of the materials generally used. It was found that methyl chloride, propane or butane can be used to replace in part the dichlordifluoromethane in pyrethrum aerosols for some purposes [*cf. R.A.E.*, B **33** 64]. Extracts of derris or ground derris root diluted with pyrophyllite or tripoli earth to a rotenone content of 1·25 per cent. have been recommended for the control of cattle grubs [*Hypoderma*] to conserve rotenone. Of 25 chemicals tested as substitutes for rotenone in sprays or dips against the short-nosed cattle louse [*Haematopinus eurysternus*, Nitzsch], nicotine sulphate and Lethane 60 [an aliphatic thiocyanate] were fairly satisfactory when used alone and very effective together. A spray containing 0·5 per cent. 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane (DDT) gave complete kill of all active stages of this louse and persisted on the hair of the cattle long enough to kill the young lice that hatched from the eggs present. Concentrations of the spinose ear tick [*Otobius megnini*, Dugès] were found to occur under salt troughs on the range and in corrals, and preliminary tests suggested that they might be controlled by chemical treatment.

DDT and its bromine analogue were outstanding among 184 synthetic organic materials and extracts of *Amorpha fruticosa*, *Willardia mexicana* and *Ryania speciosa* among 110 plant extracts tested against the house-fly [*Musca*

domestica, L.]. One of the mosquito repellents recommended to the armed forces [probably Indalone (n-butyl mesityl oxide oxalate) (*cf.* **33** 107)] was very effective in protecting dogs and horses from stable flies [*Stomoxys calcitrans*, L.]. It is also valuable in that it decreases the chance of the dogs becoming infested with *Filaria* (*Dirofilaria*) *immitis* as a result of mosquito bites. The vault and individual-bag methods of fumigating soldiers' clothing and equipment to free them of body lice [*Pediculus humanus*, L.] are outlined [**32** 20, 195], and it is pointed out that in emergency the infested articles can be fumigated in pits covered with any such available material as raincoats or newspaper.

Notes and Exhibitions [presented at meetings of the Hawaiian Entomological Society in 1943].—*Proc. Hawaii. ent. Soc.* **12** no. 1 pp. 1–29, 5 refs. Honolulu, 1944.

Water from wells in the coral plain at Ewa, Oahu, in which were large numbers of larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) as well as many of *Aëdes albopictus*, Skuse, was found on analysis to have a salt concentration (mostly sodium chloride) of 2,992 mg. per litre. Larvae of all instars and pupae were present, and the adults that emerged appeared normal. Living examples of *C. fatigans* were taken on three occasions in aircraft in flight between islands of the Hawaiian group, 10–20 minutes after spraying with pyrethrum extract suspended in Freon [dichlordifluoromethane] to form an aerosol. It appeared that the ineffectiveness of the treatment was due to the liberation of too small a quantity of the spray.

A woman bitten in numerous places on the face and arm by *Triatoma rubrofasciata*, Deg., in Honolulu in the spring of 1943 suffered from severe pain and swelling for three weeks. An unidentified species of *Metaphycus* that was first recorded in Honolulu in 1942 has been found to be an effective parasite of the oöthecae of *Supella supellectilium*, Serv., the common household cockroach there. More than 20 adults of this Encyrtid have been reared from a single oötheca, and almost all the oöthecae found in one locality had been parasitised. Examples of *Latrodectus mactans* var. *hesperus*, Chamberlin & Ivie, were collected in south central Molokai in May 1943. This variety of the black widow spider is stated to be the form that occurs in California and other parts of the western United States. *L. geometricus*, Koch, was taken in the same area on the same date, and also in fair abundance on a rocky bank at Port Allen, Kauai, in October 1942.

Zimmerman (E. C.). **A Case of bovine auricular Myiasis and some Ectoparasites new to Hawaii.**—*Proc. Hawaii. ent. Soc.* **12** no. 1 pp. 199–200. Honolulu, 1944.

The ears of a cow from the island of Molokai shot for autopsy in August 1943 were found to contain hundreds of Dipterous larvae in all stages of development. There was also a living larva in the rumen that had evidently been licked off and swallowed by the cow. The larvae that were reared yielded 275 adults of *Chrysomyia megacephala*, F., and 39 of *C. rufifacies*, Macq. A few larvae of a species of *Fannia* were also seen in the mass, but were lost. The animal's ears were also infested by *Otobius* (*Ornithodoros*) *megnini*, Dugès, and some examples of this tick had been removed a few days before. The sores caused by their removal may have been responsible for the myiasis. Three adults of the Ephydrid, *Discomyza maculipennis*, Wied., emerged with those of *Chrysomyia*, but it is thought that this was the result of contamination of the culture in the jar in spite of the precautions taken.

Other ectoparasites recorded from Hawaii include *Liponyssus bursa*, Berl., which is common in birds' nests and has caused dermatitis in man, *Polyplax*

spinulosa, Burm., on rats, *Linognathus africanus*, Kellogg & Paine, and *Damalinia* (*Bovicola*) *caprae*, Gurlt, on goats, *D.* (*B.*) *bovis*, L., on a cow, and *Felicola subrostrata*, Nitzsch, on cats.

[Palimpsestov (M. A.).] **Палимпсестов (M. A.). Differentiating Characters of the Larvae of Mange Mites of the Genus *Psoroptes* Gervais, 1841.** [*In Russian.*]—*Veterinariya* **21** no. 10 pp. 23–24. Moscow, 1944.

From morphological studies of large numbers of larvae of *Psoroptes equi*, Hering, *P. bovis*, Gerlach, and *P. ovis*, Hering, from horses, cattle and sheep, respectively, the author agrees with the view that these mites represent three distinct species and not, as has commonly been considered by Russian workers, three biological varieties of *P. equi* distinguishable only by hosts. He gives a key to the larvae of both sexes of the three mites.

Barbieri (N. A.). **Action antiparasitaire universelle du tabacol et actions (a) cicatrisante, (b) trophique et (c) stimulante des grains du tabacol.**—*Verh. 7. int. Kongr. Ent., Berlin 1938* **4** pp. 2929–2937, 3 pls. Weimar, 1939.

An account is given of various experiments with a 2 per cent. aqueous solution of tabacol [*R.A.E.*, A **21** 630], which can be applied as a spray or by means of a cotton pad or brush. It is said to have been effective against all the ecto-parasites of man and domestic animals against which it was tested.

Winkler (E.). **Ueber neue Heissluftverfahren gegen Material-, Vorrats- und Gesundheitsschädlinge.** [New Hot-air Treatments against Pests that infest Materials and Stored Products or are injurious to Health.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **4** pp. 3059–3064. Weimar, 1939.

The author briefly reviews the difficulties that have so far attended the hot-air treatment of buildings against harmful insects, including household pests, and states that one of two processes now in use in Germany for heating buildings [*cf. R.A.E.*, A **33** 255] is effective against the latter. It is known as the Thermodes hot-air process and was developed by Rennerfelt in Sweden. The heat is generated by a portable oil-burning stove and regulated by means of thermostat controls, and the air is circulated under pressure by a compressor built into the apparatus. The rooms to be treated need not be air-tight. It gives a very uniform distribution of heat and is not injurious to furniture. It will free dwellings from bed-bugs [*Cimex lectularius*, L.] in 6–8 hours, and complete control has been obtained in practice of mites, cockroaches and other household pests. In laboratory experiments, various pathogenic bacteria were destroyed in 3–6 hours, and the development of moulds and fungi prevented.

Slade (R.). **A New British Insecticide. The Gamma Isomer of Benzene Hexachloride.**—*Chem. Trade J.* **116** no. 3017 pp. 279–281. London, 1945. [From Hurter Memorial Lecture of 8th March 1945.]

Insecticide tests with many organic and other chemical compounds as substitutes for pyrethrum and derris have been in progress at one of the English laboratories of Imperial Chemical Industries for about ten years. In 1942, benzene hexachloride (1, 2, 3, 4, 5, 6-hexachlorcyclohexane), which, for brevity, was called 666, gave encouraging but inconsistent control of a number of insects in laboratory and small-scale field tests. In 1942 and 1943, a method was developed for separating the four known isomers of the compound, and tests with these showed that the α and β isomers were relatively inactive against weevils, whereas the γ isomer (gammexane), which forms 10–12 per cent. of the crude compound, was more toxic to them than any other substance tested.

Benzene hexachloride possesses considerable chemical stability; it is unaffected by exposure to light or hot water and can be crystallised from hot, concentrated nitric acid, and it will therefore be unaffected by continued exposure to the atmosphere. Although the molecule loses hydrogen chloride in the presence of alkalis such as lime-water or dry lime at 60°C. [140°F.] or ordinary temperature, it is not decomposed at either temperature by ground limestone or chalk, dry or in the presence of water, and is therefore stable in natural waters. The pure isomers are practically insoluble in water, soluble in organic solvents, almost inodorous and bitter to the taste. A finely divided powder of crude 666 and gypsum (20 : 80) further diluted for application proved to be a satisfactory substitute for ground derris against pests of crops. For some purposes the material is dissolved in an organic solvent, such as methyl alcohol, xylene, carbon tetrachloride, perchlorethylene or decahydronaphthalene (Dec); solutions containing 5 per cent. or more gammexane can be diluted for use with kerosene or other suitable oils. Concentrated solutions that give stable emulsions in water can be prepared by the addition of an emulsifying agent such as a sulphonated castor oil (selected Turkey Red Oil). A powder prepared from crude 666 or from the solid product resulting from the removal of the α isomer from this and rendered dispersible by incorporating an adequate amount of sulphite lye (Goulac), can also be used with water as diluent. Since gammexane is exceptionally stable to high temperatures, it can be applied as a smoke by volatilisation from hot plates or other heating methods.

Gammexane is highly effective against the bed bug [*Cimex lectularius*, L.] when dissolved in Dec and diluted for use with a suitable oil such as odourless distillate; this spray causes no damage to painted or french-polished surfaces, so that it can safely be used for practically any insecticidal purpose in houses. A gammexane powder has given successful control of house crickets [*Gryllulus domesticus*, L.] and cockroaches [*Blattella germanica*, L., and *Blatta orientalis*, L.] and will keep the population of house-flies [*Musca domestica*, L.] in an area at a low level if applied regularly to the litter and manure heaps on which they breed. The solution in oil is extremely toxic to adult house-flies but is improved by the addition of a small amount of pyrethrum extract to give a rapid knockdown, and a spray of the same type is effective against adult mosquitos. Preparations of gammexane gave higher kills of the larvae of the yellow fever mosquito [*Aëdes aegypti*, L.] than any other material examined; 666 is of the same order of toxicity as Paris green, but can be used in oil and is safer to man. Field experiments in various countries indicated that the product is effective against larvae of *Anopheles* and other mosquitos, and it is considered that a dosage of 1 oz. gammexane (10 oz. 666) or less per acre will give satisfactory control. Lice on pigs, red mite [*Dermanyssus gallinae*, Deg.] on poultry, and fleas [*Ctenocephalides* spp.] on dogs have all been successfully controlled with gammexane, and it was also found highly toxic to the body louse [*Pediculus humanus*, L.], the sheep ked [*Melophagus ovinus*, L.] and the sheep tick [*Ixodes ricinus*, L.]. The median lethal dosages varied considerably, but were generally lower than those of other insecticides, and the results of extensive tests carried out in 1944 indicate that gammexane is likely to be more effective against many pests of sheep and cattle than the substances hitherto employed.

Gammexane acts against insects as a stomach poison, a contact poison or a fumigant, and since these effects may be combined, the investigation of its mode of action is difficult. It may act by blocking the vital reaction dependent on inositol, a molecularly similar metabolite that is widespread in many types of cell, and DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] possibly acts in the same way, although it has only one-fifth of the power of gammexane.

In experiments on toxicity to vertebrates, the quantities per kg. body weight necessary to produce 50 per cent. kill of rats in seven days when introduced into the stomach were 1·7, 0·19, and 1 gm. of the α, γ, and δ isomers and 1·25 gm. of the mixture of isomers; the β isomer produced no mortality. Experiments

on chronic toxicity showed that rats could be fed with 10, 20 or 30 mg. gammexane per day for five weeks and with 100 mg. of the mixture per day for two months without effect. Rats were not affected when the skin of the tails and ears was painted with an emulsion containing 5 per cent. of the mixed isomers. The subcutaneous injection of 100 mg. gammexane per kg. body weight killed 25 per cent., the rest being severely affected but recovering in three days; 600 mg. mixed isomers per kg. body weight were injected without producing any effect. Saturated solutions of the α and β isomers did not affect goldfish, but gammexane was distinctly toxic at a concentration of one part per million. It is concluded that the use of 666 entails little danger to man or the higher animals, though the effect on the skin is not yet known.

Lent (H.) & de Oliveira (S. J.). **Nota preliminar sobre a ação do DDT (dicloro-difenil-tricloroetana) em insetos transmissores da doença de Chagas.** [Preliminary Note on the Action of DDT on the Insect Vectors of Chagas' Disease.]—*Rev. brasil. Biol.* **4** no. 3 pp. 329–331. Rio de Janeiro, 1944.

An account is given of preliminary laboratory experiments carried out in Brazil with a view to using DDT [2, 2-bis (parachlorphenyl-1, 1, 1-trichlorethane] for the control of Triatomid bugs. In the first test, *Rhodnius prolixus*, Stål, *Panstrongylus megistus*, Burm., *Triatoma sordida*, Stål, and *T. infestans*, Klug, were placed on petri dishes dusted with Neocide (5 per cent. DDT adsorbed on talc). The action of the DDT was slow, particularly on the immature stages, the later nymphal instars being the most resistant. One fifth-instar nymph of *T. sordida* moulted after 10 days' exposure to DDT, giving rise to an adult that became paralysed. Most of the bugs began to show signs of being affected after exposure for 18–24 hours, but survived, lying on their backs, for several days. Pure, crystalline DDT did not appear to act more quickly than Neocide. DDT did not impede embryonic development; eggs of *R. prolixus* hatched after being left in a treated dish for 20 days.

In a second series of experiments, 0·07–0·5 gm. pure DDT in gelatinous capsules was administered to pigeons weighing about 350 gm. on which individuals of *R. prolixus* were later allowed to engorge. The results were somewhat contradictory. With doses of 0·07, 0·2, 0·3–0·4 and 0·45–0·5 gm., the pigeons' blood was toxic to the bugs 3–6, 12–20, 1½–2½ and 1½–27 hours, respectively, after the birds had ingested the DDT. The pigeons were not affected by doses of 0·4 gm. or less, but those that received 0·45–0·5 gm. were affected seriously and sometimes fatally, and bugs that fed on them 1½–6 hours after they had ingested the DDT were affected within 1½–3 hours.

Muma (M. H.). **The Black Widow Spider in Maryland.**—*Bull. Univ. Maryland Ext. Serv.* no. 103, 7 pp., 3 figs., 2 refs. College Park, Md., 1944.

Latrodectus mactans, F., is widely distributed in Maryland, but is not common in the northern and western counties. It may be found indoors throughout the year and out of doors from April to November. The spider is described, and notes, based on the literature, are given on its life-history and on the effect, treatment and prevention of its bites. Figures for 11 years show that cases of poisoning, severe enough to require hospital treatment, have been infrequent in Maryland and no fatal case has been reported.

Papers noticed by Title only.

Stiff jr. (H. A.) & Castillo (J. C.). **A colorimetric Method for the Micro-determination of 2, 2, bis (p-chlorophenyl) 1, 1, 1, trichlorethane (DDT).**—*Science* **101** no. 2626 pp. 440–443, 1 graph, 5 refs. Lancaster, Pa., 1945.

Goodhue (L. D.). **New Developments in Insecticides** [a review of the literature].—*Iowa St. Coll. J. Sci.* **19** no. 3 pp. 255–262, 33 refs. Ames, Iowa, 1945.

HUNDLEY (J. M.) & NASI (K. W.). **Anti-plague Measures in Tacoma, Washington.**—*Publ. Hlth Rep.* **59** no. 38 pp. 1239–1255, 4 figs. Washington, D.C., 1944.

A case of plague in man was found in a vessel at Port Townsend, Washington, in 1900, three more occurred in Seattle in 1907 and infected rats were discovered intermittently in that city until 1917. After this, there were no indications of plague in any city on Puget Sound until seven samples of fleas and other ectoparasites from 257 rats trapped near two large flour mills on the western water front of Tacoma harbour were found to be infected with plague in the autumn of 1942. The origin of the infection is discussed. Tacoma lends itself to the spread of infection by its situation and size and the presence of many old frame buildings, and there was a danger of the outbreak spreading to man on account of the overcrowding as a result of wartime conditions.

The measures taken by the United States Public Health Service consisted of a preliminary survey of sanitary conditions and of the rat population by trapping (in the first instance progressively from outside the focus towards its centre to avoid dispersal of the rats) and examination of the rodents and their ectoparasites for plague, followed by rat control by trapping, poisoning and gassing, fumigation of large flour mills, reduction of the available food and harbourage, rat-proofing of buildings, inspection and treatment of ships and rolling stock, and educational activities. *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, an efficient vector, comprised 95 per cent. of the fleas found on the rats, but the average number of fleas per animal was only 1·2. Only nine individuals of *Xenopsylla cheopis*, Roths., all from an area where plague was not present, were identified among the hundreds of fleas examined. Out of 1,765 pools of fleas tested, with an average of 17 per pool, 54 were positive, and out of 592 pools of rodent tissue, 34 were positive. It was estimated that 0·27 per cent. of fleas and 0·22 per cent. of rats were infected. The last positive specimen was found on 4th May 1943. After that date, 8,000 rodents and their ectoparasites were examined with negative results. Although other rats occasionally carried infected fleas, plague was confined to *Mus* (*Rattus*) *norvegicus*, which lives in places with which man does not have intimate contact, and few people were in the principal infected areas at night. These facts probably contributed to prevent the infection spreading to man.

BARBER (M. A.). **A Measurement of the Toxicity to Mosquito Larvae of the Vapor of certain Larvicides.**—*Publ. Hlth Rep.* **59** no. 39 pp. 1275–1278, 1 ref. Washington, D.C., 1944.

A method of studying the action of vapours of larvicides on mosquito larvae is described. A petri dish is lined with filter paper having a hole 3 cm. in diameter in the centre, the filter paper is saturated with the larvicide, a watch-glass containing ten or more larvae in a very little water is placed over the hole and the lid of the dish is replaced. The hole facilitates observation of the larvae. The intensity of the vapour can be roughly estimated by the exposed surface area of liquid larvicide. If a greater intensity is required, the top of the dish is lined like the bottom. It is advisable to add a piece of wet cotton-wool or filter paper to prevent the water in the watch-glass from evaporating. Larvae of *Aëdes aegypti*, L., two days old, were used as test insects, and the results were recorded as the time required to render them NT (non-travelling) and the time required to render them inert. As the larvae of a single batch vary greatly in their reaction, the earlier effect is usually measured on the majority rather than on all. Plain water and kerosene are used as controls. The toxicity of a given vapour can be indicated by expressing the time it requires to cause NT as a fraction of the time required by standardised kerosene. For the procedure described to be of use in comparing liquid larvicides to be used as films,

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the toxicity of the vapour would have to be of the same order as that of the film. Although the work was interrupted, enough was done to indicate that vapour tests may have some value in the standardisation of larvicides.

The vapour of carbon bisulphide had the most rapid action of any tested, its effect being noticeable in less than a minute. The vapours of toluene, carbon tetrachloride and benzene acted almost as rapidly and those of xylene and petrol took effect in 2 or 3 minutes. Phenol and the samples of kerosene tested required 12 30 minutes to render the larvae NT, and fuel oil much longer. Kerosene caused a slowing of the action of the larval heart with subsequent recovery. The destruction of mosquito larvae by gases might be contemplated in the case of deep wells, reservoirs or pits.

[**Papers on Mosquito Control.**]—*Mosq. News* **4** no. 3 pp. 65–101, 13 figs. New Brunswick, N.J., 1944.

These papers include **References to Literature of Interest to Mosquito Control Workers** by H. H. Stage (pp. 94–101) and **Malaria Control in the Tennessee Valley** by A. D. Hess & C. C. Kiker (pp. 65–77, 13 figs.). In the latter, the procedure adopted for the control of *Anopheles quadrimaculatus*, Say, the local vector of malaria, on the reservoirs of the Tennessee Valley Authority before and after the water is impounded is reviewed from the literature. The main features are the preparation of the reservoir by clearing, draining marginal depressions between maximum and minimum levels, finally reconditioning the zone of fluctuation just before filling, and impounding in winter; shoreline maintenance, by the removal of annual growth from the zone of fluctuation, removal of aquatic plants, encouragement of grazing on the shoreline and maintenance of drainage ditches; permanent improvement of the shoreline [*R.A.E.*, B **33** 124]; water-level management [**33** 122]; mosquito proofing of houses [**30** 94 etc.]; and the application of Paris green from aircraft [**33** 123] and of Paris green or oil from boats and by hand. Primary emphasis is placed on the use of water-level management and permanent shoreline improvement rather than the application of larvicides.

Knight (K. L.), Bohart (R. M.) & Bohart (G. E.). **Keys to the Mosquitoes of the Australasian Region, including a Synopsis of their Distribution and Breeding Habits.**—[3 +] 71 pp. multigraph, 13 refs. Washington, D.C., Nat. Res. Coun., Div. med. Sci., July, 1944. Additions and Corrections to the Key.—1 p. multigraph. August, 1944. (Issued by Off. med. Inform.)

The area considered in this paper extends to the Moluccas on the west and the Marianas, the Hawaiian Islands and the Tuamoto Archipelago on the north and east. The south-western part of the region (New Zealand, Tasmania, Victoria, South Australia and Western Australia) is excluded because of its distance from the zone of military activity. Keys are given to the adults of the subfamilies and tribes of mosquitos and to the tribes, genera and species of Culicinae occurring in the area. In general, the keys apply only to females, except where the distinction of species depends on male characters. Some unnamed species that had not been described at the time of publication are included in them. They are followed by a table showing the distribution and larval habitats of the various species.

Taylor (F. H.). **Contributions to a Knowledge of Australian Culicidae. No. VII.**—*Proc. Linn. Soc. N.S.W.* **69** pt. 3–4 pp. 120–128, 14 figs. Sydney, 1944.

In this part of a series [*cf. R.A.E.*, B **32** 147], notes are given on the characters and synonymy of several Australian mosquitos, and one new species is described. A modification is made in the description of *Aëdes* (*Leucomyia*)

albitarsis, Tayl. [**2** 135] of which *A. palmarum*, Edw. [**12** 114] is considered a synonym. *A. priestleyi*, Tayl., and *A. pecuniosus*, Edw. [**10** 153] are considered synonyms of *A. purpureus*, Theo. *A. cunninghami*, n. n., is proposed for *A.* (*Skusea*) *bancrofti*, Tayl. [**3** 37] nec *Culex bancrofti*, Skuse, which is a synonym of *A. aegypti*, L.

SENIOR WHITE (R.) & VENKAT RAO (V.). **Regulation of the Control of *Anopheles* of the *fluviatilis*-group by anti-adult Spraying.**—*Indian med. Gaz.* **79** no. 8 pp. 364–369, 1 fig., 7 refs. Calcutta, 1944.

The species of *Anopheles* belonging to the *fluviatilis* group (*A. fluviatilis*, James, *A. varuna*, Iyen., and *A. minimus*, Theo.) are all known to be very efficient vectors of malaria in India, and the extension of *A. minimus* across the Burmese hills into Indo-China and southern China as far as Hong Kong gives it great importance in connection with the war against Japan. The first author has had in progress for two years a series of experiments designed to extend the work of Thomson on the adult biology of *A. minimus* [*R.A.E.*, B **30** 170] and to ascertain the effect of spraying in houses with pyrethrum extract in kerosene on the numbers and behaviour of eight species of *Anopheles*. A summary is here given of the results obtained regarding the three species of the *fluviatilis* group and the practical conclusions to be drawn from them. It is believed that they make it possible to effect control without the great expenditure of insecticide that is causing a serious shortage.

It was found that in a house from which all Anophelines are removed daily, 96 per cent. of the females of *A. fluviatilis* and *A. varuna* and all those of *A. minimus* are freshly fed in the morning. If the house is cleared of mosquitos once a week only, 82 per cent. of the females of *A. fluviatilis* and *A. minimus* and 94 per cent. of those of *A. varuna* are freshly fed. The number of any of these species found resting in empty houses is only 11–15 per cent. of the number found in inhabited houses. The number of *A. fluviatilis* in a house containing only a cow as bait is not more than 16 per cent. of that in a similar house with a human bait, but the corresponding percentages are 50 for *A. minimus* and almost 100 for *A. varuna*. However, the anthropophilic index (proportion of freshly fed females containing human blood) is 67 per cent. in females of *A. varuna* caught near the cow as compared with 81 per cent. for those caught at human bait, which shows that most of the former (all of which are freshly fed) are only resting after feeding on man nearby. Daily spraying halves the total numbers of *A. fluviatilis* and *A. varuna*, but reduces those of *A. minimus* by 27 per cent. only. It reduces the number of old females (those with stage III and IV wings [**29** 93]), which are the potentially infective ones, by 71 per cent. in the case of *A. fluviatilis* and to 0 in that of *A. varuna*. So few old females of *A. minimus* were taken during the two years that the comparison cannot be made for this species. Weekly spraying reduces the numbers of old females of *A. fluviatilis* and *A. varuna* by 66 and 38 per cent., respectively. In all three species, it causes an increase in the numbers resting as compared with a similar unsprayed house. This is unexplained and does not occur in the case of *A. culicifacies*, Giles.

It is concluded from these findings that there is an almost complete turn-over of mosquitos of the *fluviatilis* group in a house each day, departure is not delayed by lowered temperatures, and only a few of the departing females pass from houses to cow-sheds or empty houses, except in the case of *A. varuna*. The others go to places inaccessible to spray, so that each individual is vulnerable for only one daylight period in each digestion-ovarian cycle, irrespective of the length of this period. In areas such as the hills of the Central Provinces, where *A. varuna* forms a considerable percentage of the total numbers of the group, it is worth including cow-sheds in the spraying programme. The authors' findings and those of Thomson [**30** 170] taken in conjunction show that each individual of the group feeds every 48 hours in the hot, damp season, and every

96 hours in cool weather. When the cycle is longer than this, the weather is probably too cold for malaria parasites to develop. The mosquito feeds between midnight and dawn, leaves the house at dusk next evening, remains away until it has oviposited, and then enters a house about midnight or later to feed again. It is therefore useless to spray before going to bed to prevent malaria transmission by these species.

Knowles & Basu's determinations of the duration of the cycle of development of *Plasmodium vivax* and *P. falciparum* in *A. stephensi*, List., at different temperatures are quoted [*cf.* **32** 148–149] in the absence of similar information for the *fluviatilis* group. They show that the females must be destroyed before the ninth day after their infecting feed in the monsoon period, before the tenth day in the autumn and before the fourteenth in the winter to prevent transmission. A chart is given showing that a mosquito with a 48- or 96-hour digestion-ovarian cycle is vulnerable on four days and one with a 72-hour cycle on three before it becomes infective. Daily spraying is now seldom possible on account of the scarcity of pyrethrum, but it is difficult to devise schemes for spaced spraying that will give two chances of hitting the maximum number of mosquitos before they develop gland infections. Two are suggested for temperatures of 70, 80 and 90°F., one being more intensive and expensive than the other. To illustrate the effect of spaced spraying on malaria, data from two railway stations in the Singhbhum Hills are given. In the first, spraying on six days a week effected a 24 : 1 reduction in the density of Anophelines of the *fluviatilis* group as compared with an unsprayed control, and malaria incidence was reduced to 11 per cent. as compared with 27 per cent. in a preceding period. In the second, spaced spraying on 15 days a month effected a reduction in density of 6 : 1 as compared with an unsprayed control, and malaria incidence was only 2 per cent. higher than the average for the previous three years when spraying was carried out daily. This difference was probably not significant. In both stations, the infection rates of the surviving mosquitos were unaltered.

The repellent effect of kerosene is discussed. It is not certain whether it prevents the mosquitos from entering a house to feed or only from remaining to rest. In the former case, it would be beneficial, and spraying with kerosene alone could be used in conjunction with spaced spraying on the intervening days, if there was an untreated village near. Where data on seasonal intensity of infection exist, it may be advisable to increase the frequency of spraying during the time of most intense transmission. It is emphasised that the procedure described is applicable to the *fluviatilis* group only.

SHUTE (P. G.). **Indigenous Malaria and Mosquito Control in England after the War.**—*J. R. sanit. Inst.* **64** no. 2 pp. 85–93, 5 figs. London, 1944.

The outbreak of malaria that occurred in England at the end of the war of 1914–18 and in the years immediately following is described, and the life-cycle of the parasite in man and mosquito is outlined as an introduction to a discussion of the question of the possible recurrence of indigenous malaria in England as a result of the return of infected persons from malarious war-service areas [*cf. R.A.E.*, B **18** 226.]. There were over 600 cases of locally acquired malaria in England in 1917–26, nearly all of which occurred, like those in the latter half of the nineteenth century, along the east coast and the eastern half of the south coast. There were small epidemics in some districts in Kent. This distribution is attributed to the fact that of the four species of *Anopheles* that occur in Britain (*Anopheles algeriensis*, Theo., *A. claviger*, Mg., *A. plumbeus*, Steph., and *A. maculipennis* vars. *atroparvus*, van Thiel, and *messeae*, Flni., the only form that is likely to transmit malaria there is the domestic *A. maculipennis* var. *atroparvus*, which breeds in brackish water more extensively than in fresh, and is much more abundant in the south and south-east than elsewhere. The

only type of malaria likely to spread in England is benign tertian, caused by *Plasmodium vivax*. The inability of *P. vivax* to develop at temperatures lower than 60°F. limits its distribution in the British Isles and the season at which transmission can take place. It survives in man for periods of up to two years. Relapses may occur after several months. The sexual stages of the parasite are seldom found until about the seventh day of untreated fever in a primary attack, but are often present from the first day in a relapse. The incubation period, usually 10–12 days, may be as long as 12 months.

To prevent the disease from spreading after an initial outbreak, anti-malarial drugs should be administered to patients to free the blood from gametocytes, so that Anophelines cannot be infected by them, animal quarters and houses, particularly patients' bedrooms, should be sprayed to kill adult mosquitos and, where Anophelines are numerous, the reduction of actual and potential breeding places and the destruction of larvae should be considered. In coastal districts where the marshes are below high-tide level, spraying with a suitable oil is the most satisfactory anti-larval measure. As *A. maculipennis* breeds continuously in England from the middle of May to early September, the water should be treated at least once a fortnight throughout this period. Attention should be concentrated on the breeding places close to houses where cases have occurred or adults been found.

GARNHAM (P. C. C.) & HARPER (J. O.). **The Control of rural Malaria by Pyrethrum Dusting.**—*E. Afr. med. J.* **21** no. 10 pp. 310–320, 1 fig., 5 refs. Nairobi, 1944.

In view of the reduction effected in mosquito populations in native huts in Kenya Colony by dusting with pyrethrum powder [*R.A.E.*, B **30** 176], a further trial of this method of control was made, although W. Grainger had reported in a personal communication that in his experience at Mombasa, little improvement in the malaria rate had followed the killing of Anophelines in this way. Fifty dark, single-roomed, mud-and-pole native huts with thatched roofs in a village in the Maragoli District of North Kavirondo, Nyanza Province, Kenya, were dusted twice a week with about 1 oz. pyrethrum powder (containing 2·5 per cent. pyrethrins) per 1,000 cu. ft. from April to October 1942 and twice this amount from November 1942 to August 1943. The powder was directed chiefly towards the roof. The parasite rates of about 100 children living in the huts were determined on five occasions in the course of the experiment, and compared with the rates prevailing among a similar number of children living in an untreated village, a mile away. The smaller dosage effected little, but by August 1943, the parasite rate for *Plasmodium falciparum* in the treated huts was little more than half of what it would have been if the huts had not been dusted and the rate had followed the same trend as in the control village. There was no decrease in the rate for *P. malariae*, which was less common and persists for many years. This reduction in the parasite rate was effected without the help of other measures. Eradication of the disease by dusting alone, however, is not considered possible because Africans travel considerably and acquire infection while away from home and children are often out of doors after dark and again before daybreak. It is also pointed out that the Anopheline population in this case was very small compared with that of huts in a hyperendemic area 15 miles away, and that this enabled measures giving less than 100 per cent. control to affect the parasite rate. However, it is suggested that, combined with other measures, dusting of huts with pyrethrum may prove of considerable value in temporary camps in epidemic (not hyperendemic) zones and for controlling epidemics in large rural areas.

Observations of mosquito populations during the experiment showed that *Anopheles gambiae*, Giles, appeared with the long rains, followed three months later by *A. funestus*, Giles, and slightly later by the typical form of *A. marshalli*,

Theo. The last was common in houses, but dissection of 487 females showed no gland infections. Very small numbers of nine other species of *Anopheles* were taken. A microfilaria, identified as *Filaria* (*Microfilaria*) *perstans*, but showing a constant peculiarity in the form of a bulbous swelling of the hind end, was found in the blood of about 18 per cent. of the children examined, regardless of locality or season. Immature forms of this parasite were found in locally collected examples of *Culicoides trichopis*, De Meillon, by J. C. Buckley, who also infected individuals of this species from human carriers.

[Olenev (N. O.).] **Оленев (Н. О.). Mosquitos of the Lower Volga and their Control.** [*In Russian.*]—88 pp., 46 figs., 3½ pp. refs. Saratov, Oblgiz, 1940. Price 3 *rub.* 35 *kop.* [Recd. 1945.]

This handbook is intended for the use of medical officers, students and workers engaged in malaria control. After brief accounts of the nature of malaria, the rôle played by mosquitos in its transmission, and the natural conditions that obtain in the Lower Volga Region, annotated lists are given of the mosquitos that occur there, with notes on their local distribution and breeding places, and keys to the genera and species based on larvae and adults. The species of *Anopheles* present are *A. claviger*, Mg. (*bifurcatus*, auct.), which is rare, *A. hyrcanus*, Pall., which occurs only near the Caspian Sea, and *A. maculipennis*, Mg., which is widely distributed and is the local vector of malaria. All stages of *A. maculipennis* and its bionomics are described in detail. It is represented in the region of the Lower Volga by vars. *typicus* and *messeae*, Flni. A key is given to the eggs of all the six varieties that occur in the Russian Union. The methods of detecting infection in Anophelines by determining their oöcyst or sporozoite indices are described, and control measures are dealt with at some length. Those discussed include measures against adult mosquitos, such as zooprophylaxis, improvement in the type of dwellings, screening, dusting and spraying in houses and fumigating hibernation quarters and day-time shelters, and measures against the larvae, such as elimination of the breeding places, the introduction of *Gambusia*, dusting with Paris green, and oiling. A final section contains notes on the apparatus used in dusting, spraying and oiling.

Lever (R. J. A. W.). **Division of Entomology. Annual Report for the Year 1943.**—*Agric. J. Fiji* **15** no. 3 pp. 73–75. Suva, 1944.

The Arthropod pests recorded in Fiji during 1943 included *Cimex hemipterus*, F., in stretchers and a mosquito canopy, *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., from the floors of a hospital, *Rhipicephalus sanguineus*, Latr., in concrete walls, and *Lucilia cuprina*, Wied., which was taken in large numbers on pig dung but was not found breeding there. No *Anopheles* were found in aircraft or aerodromes. *Culex annulirostris*, Skuse, was the most widespread mosquito, *Aëdes vexans*, Mg., was common in broken ground and *C. fatigans*, Wied., in drains. *Hister* (*Platylister*) *chinensis*, Quensel, was liberated in various localities for the control of house-flies [*Musca domestica vicina*, Macq.] breeding in cow dung [*cf. R.A.E.*, B **29** 57–58].

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **15** no. 3 pp. 76–80, 17 refs. Suva, 1944.

Culex sitiens, Wied., was found in Fiji to develop from egg to adult in still, undiluted sea water with a sodium chloride content of 3,040 parts per 100,000.

A sample of DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] was tested for the control of mosquito larvae. All those of *Aëdes scutellaris pseudoscutellaris*, Theo., and *C. fatigans*, Wied., died in a metal drum in water with a surface area of 2 ft. 8 ins. by 1ft. 10 ins. that was sprayed with 2 cc. of a 5 per

cent. solution of DDT in a volatile mineral oil at the end of January and protected from rain, but larvae in an exposed drum similarly treated were found to be alive because heavy rain caused the water and oil film to overflow. When the experiment was repeated in a modified form in June, eggs were found after seven weeks in the drum with the oil alone, whereas in the one treated with DDT, none had been laid after twelve weeks and the surface of the water was covered with dead mosquitos and other insects. In another trial, in which 4 cc. of 5 per cent. DDT in diesel oil was applied to water standing in a disused soapstone air-raid shelter and containing larvae of *C. fatigans*, no living larvae could be found on the following day. Finally, DDT was applied as a 5 per cent. solution in oil to part of a patch of swampy and weedy ground where *C. fatigans* and *C. annulirostris*, Skuse, were breeding, and as a dust of one part DDT and nine parts ground soapstone elsewhere in the same swamp. No larvae could be found two days later. It is concluded that one quart of oil with DDT is as effective as 10–14 gals. oil alone, and spraying of marshes should therefore become economically possible in Fiji.

JEFFERY (G. M.). **Investigations on the Mosquito Transmission of *Plasmodium lophurae* Coggeshall, 1938.**—*Amer. J. Hyg.* **40** no. 3 pp. 251–263, 16 refs. Lancaster, Pa., 1944.

The following is based on the author's summary of the results of attempts to produce satisfactory infections with *Plasmodium lophurae* in vertebrate hosts by means of the sporozoite stage. *Anopheles quadrimaculatus*, Say, and to a smaller extent, *Aëdes albopictus*, Skuse, and *A. aegypti*, L., acquired infection with *P. lophurae* from ducks, and sporozoites matured in them, but *Culex pipiens*, L., did not become infected [*cf. R.A.E.*, B **30** 22, 95]. Raising the temperature at which females of *A. albopictus* were kept after the infecting meal from 21–23°C. [69·8–73·4°F.] to 30°C. [86°F.] had no significant effect on the rate of infection but decreased the time necessary for the sporozoites to develop from 11–12 to 6–7 days, and mosquitos kept at the higher temperature showed a slightly greater average number of oöcysts than those kept at room temperature [*cf.* **30** 84]. The rate of infection in *A. albopictus* increased with the number of parasites and gametocytes in the carrier bird, but reached its peak before the numbers of parasites and gametocytes in the bird had reached their maximum.

P. lophurae was transmitted to 29 of 46 ducks by injection of sporozoites from all the three species of susceptible mosquitos, whether they were kept at 21–23 or at 30°C. [*cf.* **29** 59], and to 2 of 6 ducks by bite. In all but three of the positive cases, the number of parasites appearing in the blood was very low [*cf.* **31** 186]. It was not correlated with the number of sporozoites inoculated. Pheasants were extremely susceptible to the blood stages of *P. lophurae*, and injection of sporozoites from *A. albopictus* was successful in all the three attempts made, but the number of parasites appearing in the blood was as low as in ducks. Eleven ducks in which no parasites had been observed following the injection of sporozoites were not immune from a superinfecting dose of parasites from the blood of infected ducks ; of ten ducks that had been visibly infected after the injection of sporozoites, four were immune from such superinfection but six were not, probably because they had completely recovered, or infection was still patent and little immunity had developed. The pre-patent and patent periods in successful sporozoite infection were much longer than those that followed the introduction of infected blood. Possible reasons for the poor results obtained in the transmission of *P. lophurae* from mosquitos to ducks are discussed, and it is concluded that the cause must lie in the duck, which is apparently an abnormal host and is probably unsuitable for the development of the stage of the parasite that must follow the introduction of sporozoites and precede the erythrocytic cycle.

HENDERSON (C. A.). **Control of *Aëdes aegypti* in Savannah.**—*Publ. Hlth Rep.* **59** no. 41 pp. 1350–1352. Washington, D.C., 1944.

In March 1943, a Control Unit was established at Savannah, Georgia, for the purpose of reducing the population of *Aëdes aegypti*, L., and the likelihood of an epidemic of yellow fever or dengue. Breeding was recorded in about 14 per cent. of the inspected premises in June 1943 and in over one-third in late July, but in only 2 per cent. in June 1944. This reduction is attributed largely to measures taken by the inhabitants themselves as a result of extensive propaganda.

BARBER (M. A.). **The Rearing of sterile Adult *Anopheles*.**—*Publ. Hlth Rep.* **59** no. 42 pp. 1384–1387, 2 refs. Washington, D.C., 1944.

A method is described of obtaining living adults of *Anopheles quadrimaculatus*, Say, uncontaminated with micro-organisms, in sufficient numbers for experimental purposes, by rearing them from sterilised eggs in a medium consisting of autoclaved liver extract, brewers' yeast and tap or distilled water in the presence of a single species of ciliate. The adult mosquitos were shown to be free from ciliates or any other micro-organism. After the fourth instar was reached, the food requirements of the larvae were relatively great and mortality considerable. Limited tests indicated that the method was applicable also to other species.

METCALF (R. L.) & HESS (A. D.). **The Relation of Particle Size to the Effectiveness of Paris Green used in Airplane Dusting for Mosquito Control.**—*Publ. Hlth Rep.* **59** no. 45 pp. 1458–1465, 1 pl., 1 fig., 7 refs. Washington, D.C., 1944.

The following is based largely on the authors' summary. Previous work in the United States had shown that in dusting with Paris green from an aeroplane for the control of larvae of *Anopheles quadrimaculatus*, Say, an average of about 75 per cent. of the material drifted away from the area to be treated, on account of its fine particle size [*R.A.E.*, B **31** 53; **33** 123–124]. Studies were therefore undertaken to determine whether the effectiveness of the application could be improved by increasing the particle size of the dust. Laboratory experiments carried out in 1943 showed that the average maximum diameters of particles ingested by larvae of *A. quadrimaculatus* in the first four instars were 29, 51, 68 and 106 microns, respectively. The median lethal dose of Paris green for fourth-instar larvae was 0·05 mg. per gm. body weight, or the equivalent of a particle about 40 microns in diameter. Toxicity tests with fourth-instar larvae indicated no significant difference between the effectiveness of particles of Paris green 1 micron or less in diameter and those 50–75 microns in diameter. A sample of Paris green of which 88 per cent. by weight consisted of particles 20–50 microns in diameter was therefore compared in field tests with a standard sample which had 50 per cent. by weight in this size range. Both were applied from aircraft at a concentration of 22·2 per cent. in soapstone, and the percentages of Paris green that reached the treated areas were 42·8 and 26·5, respectively. The coarse dust killed 90–100 per cent. of the larvae under average conditions. Manufacturing costs for the coarse dust were no greater than for the standard product, and it is therefore considered that specifications for Paris green to be used in dusting from aircraft, which at present fix a maximum limit on particle size, but no minimum, should be revised to encourage the production of a more desirable material.

STEINHAUS (E. A.) & PARKER (R. R.). **The Isolation of a filter-passing Agent from the Rabbit Tick** *Haemaphysalis leporis-palustris* **Packard.**—*Publ. Hlth Rep.* **59** no. 47 pp. 1528–1529. Washington, D.C., 1944.

The authors record the isolation from two lots of nymphs and adults of *Haemaphysalis leporis-palustris*, Pack., collected at Camp Bullis, Texas [*cf. R.A.E.*, B **32** 132], in July 1943, of two strains of an unidentified filter-passing agent, presumably a virus, which caused a non-fatal infection in guineapigs and other laboratory animals, with fever and enlargement of the spleen. No cross immunity was noted between this agent and those of American Q fever [*Rickettsia diaporica*] or Rocky Mountain spotted fever.

VAN THIEL (P. H.). **The Identification of the Pupae of** *Anopheles superpictus*, *Anopheles bifurcatus* **and the different Biotypes of** *Anopheles maculipennis*.—*Acta leidensia* **15–16** p. 283. 1940. (Abstr. in *Bull. Inst. Pasteur* **42** no. 11–12 p. 354. Paris, 1944.)

Comparative descriptions are given of the spines of the sixth and seventh abdominal segments of the pupae of the varieties *messeae*, Flni., *atroparvus*, van Thiel, *labranchiae*, Flni., *sacharovi*, Favr (*elutus*, Edw.), *melanoon*, Hackett, *subalpinus*, Hackett & Lewis, and *typicus* of *Anopheles maculipennis*, Mg. The terminal seta of the paddle is also useful for the identification of *sacharovi*. Unfortunately, these characters are not definite, and examination by a specialist is necessary for the best use to be made of them.

SANDICCHI (G.). **Razze di** *Anopheles maculipennis* **nella campagna romana.** [Races of *A. maculipennis* in the Roman Campagna.]—*Riv. Malariol.* **21** pp. 295–303. 1942. (Abstr. in *Bull. Inst. Pasteur* **42** no. 11–12 p. 355. Paris, 1944.)

Observations in the neighbourhood of Rome showed that *Anopheles maculipennis*, Mg., is represented there principally by var. *typicus*, the most abundant form in the intensively cultivated areas close to the city where malaria is least widespread, and var. *labranchiae*, Flni., which is found chiefly in the brackish water of the coastal regions from Palidoro to Ardea where the incidence of malaria is highest. Var. *messeae*, Flni., occurs in the coastal districts in early spring and in autumn, but is scarce.

PATRISSI (T.). **Recrudescenze malariche in territori bonificati.** [Recrudescence of Malaria in reclaimed Territory.]—*Riv. Malariol.* **21** p. 376–381. 1942. **L'anofelismo in provincia di Rovigo.** [Anophelism in the Province of Rovigo.]—*T.c.* pp. 441–455. (Abstr. in *Bull. Inst. Pasteur* **42** no. 11–12 pp. 355–356. Paris, 1944.)

A considerable number of cases of tertian malaria [caused by *Plasmodium vivax*] occurred suddenly in 1940–41 among the population of two communes in the Province of Rovigo, northern Italy, where the incidence of the disease had decreased since 1901 until it had almost disappeared. The recurrence of infection appeared to be due to the presence of *Anopheles maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.), which comprised 25 per cent. of the Anophelines found. It had not been seen at all in a survey made in 1935, and the forms most frequently taken then were vars. *messeae*, Flni., and *typicus*.

In the second paper, details are given of the conditions under which *A. maculipennis* var. *sacharovi* occurred. It was observed not only in the coastal parts of the Po delta but in fresh water some 26 miles inland. The unimportant variety, *melanoon*, Hackett, was also abundant all over the Province. The morphology of some of the eggs found suggested that hybridisation might be taking place between the two forms. Var. *labranchiae*, Flni., was very scarce and apparently of no importance.

NESTERWODSKAJA (J. M.). **Zur Oekologie von** *Anopheles claviger* (*bifurcatus*) **Meigen im Kiewer Gebiet.** [On the Ecology of *A. claviger* in the Kiev Region.] —*Dtsch. tropenmed. Z.* **46** pp. 538–543. 1942. (Abstr. in *Bull. Inst. Pasteur* **42** no. 11–12 p. 357. Paris, 1944.)

Anopheles claviger, Mg. (*bifurcatus*, auct.) is widespread in the region of Kiev. The larvae occur in spring water in forest and woodland throughout the year except in June and July. The adults are most abundant in May, September and October, favour outdoor resting places and appear to play no part in the transmission of malaria.

NESTERWODSKAJA (K.) & LUBINSKI (G.). **Anwendung von Thiodiphenylamin in der** *Anopheles***bekämpfung.** [The Use of Thiodiphenylamine in Anopheline Control.]—*Dtsch. tropenmed. Z.* **47** p. 252. 1943. (Abstr. in *Bull. Inst. Pasteur* **42** no. 11–12 p. 362. Paris, 1944.)

Phenothiazine (thiodiphenylamine) was shown in the laboratory and in the field to be toxic to mosquito larvae, bees and fish, but harmless to mammals. In the laboratory, in water with a temperature of 18–21°C. [64·4–69·8°F.], 0·5–1 mg. per 100 sq. cm. surface killed Anopheline larvae of the first three instars in six hours and fourth-instar larvae in 24 hours. Contact with the insecticide layer for 1–1½ hours caused complete mortality. In the case of fourth-instar larvae of *Culex*, only 40–50 per cent. mortality was achieved. In nature, good results against Anophelines were obtained with phenothiazine at rates of 0·45–0·9 lb. per acre.

HOHORST (W.). **Die Zecke** *Dermacentor marginatus* **Sulzer 1776, ihre Verbreitung, Lebensweise und medizinische Bedeutung.** [The Tick *D. reticulatus*, its Distribution, Habits and medical Importance.]—*Z. Parasitenk.* **13** no. 1 pp. 118–146. 1943. (Abstr. in *Bull. Inst. Pasteur* **43** no. 3–4 p. 94. Paris, 1945.)

The author describes the systematic position of *Dermacentor reticulatus*, F., for which the name *D. marginatus*, Sulz., is used, the morphology of its various stages, its geographical distribution and the microclimatic conditions that determine this and its life-cycle and habits. The incubation period, and the larval and nymphal stages, counted from the end of feeding in both cases, lasted 15–20, 5 and 18 days, respectively, in the laboratory in Germany and the length of the complete cycle is stated to be 54–72 days and the number of eggs laid by one female 5,000–7,000. Oviposition lasts some three weeks. The characteristic behaviour of each stage is described at length, the hosts on which they are found in nature are indicated, and an account is given of the conditions necessary for rearing the tick in the laboratory, with particular reference to the most suitable hosts and the humidity requirements of some stages. In conclusion, the anaemia and cutaneous lesions caused in sheep by the attachment of *D. reticulatus* and the part this tick plays in the transmission of *Piroplasma caballi* of horses and *P. canis* of dogs are discussed.

RODHAIN (J.) & BONE (G.). **Essais d'infection de la cavité générale de la tique** *Ornithodorus moubata* **par** *Trypanosoma pipistrelli* **et** *T. vespertilionis*.— *Acta biol. belg.* **3** no. 1–2 pp. 5–8. 1943. (Abstr. in *Bull. Inst. Pasteur* **43** no. 3–4 p. 96. Paris, 1945.)

An account is given of laboratory experiments in which *Ornithodoros moubata*, Murr., was infected with cultures of *Trypanosoma vespertilionis* and *T. pipistrelli* by inoculation into the haemocoele at the point of removal of a leg or by haemocoelic and intestinal inoculation through the cuticle. Haemocoelic infections alone were of short duration with both trypanosomes, but when

accompanied by intestinal infection they were longer and more severe. Transmission from tick to tick was not effected by injection of infected haemocoelic fluid. The temporary infections obtained were not mere survival of the flagellates, but were accompanied by intra- or extracellular multiplication of these, and cytological reactions of the haemocoelic fluid. The flagellates developed to the crithidial or sometimes the metacyclic trypanosome stage.

Rodhain (J.) & van Oye (E.). **Sur le rôle d'*Argas reflexus* dans la transmission du paratyphus des pigeons.**—*Acta biol. belg.* **1** pp. 216–220. 1941. (Abstr. in *Bull. Inst. Pasteur* **43** no. 3–4 pp. 96–97. Paris, 1945.)

In laboratory experiments, the *Salmonella* that causes paratyphoid of pigeons survived for at least three months when ingested by *Argas reflexus*, F., and retained its pathogenic power. The organism did not seem to harm the ticks at laboratory temperature, but at 22°C. [71·6°F.] or higher, death was rapid. When this occurred, the body was dark brown and swollen and the legs became reddish, indicating the diffusion of the haemoglobin of the red cells in the haemocoelic fluid. Infected ticks that engorged on uninfected pigeons did not transmit the disease, nor did infected females pass on the infection to their offspring, but pigeons and mice contracted the disease by feeding on infected ticks. Pigeons might become infected in this way in nature and also by eating food soiled by the excreta of infected mice.

Bloxsom (A.) & Chandler (A.). **Transient Paralysis due to Bite of American Dog Tick (*Dermacentor variabilis* Say).**—*Amer. J. Dis. Child.* **67** no. 2 pp. 126–127. 1944. (Abstr. in *Bull. Inst. Pasteur* **43** no. 3–4 p. 97. Paris, 1945.)

A paralysis that occurred in a young child in Texas was found to be caused by a female of *Dermacentor variabilis*, Say, that had attached itself to the scalp. There was fever accompanied by cervical, ganglionic inflammation. Rapid recovery followed the removal of the tick. This is stated to be the fourth recorded case of paralysis caused by *D. variabilis* [*cf. R.A.E.*, B **32** 103].

Sapre (S. N.). **Observations on the Biology of *Ornithodorus papillipes* Birula.**—*Indian J. vet. Sci.* **13** pt. 2 pp. 162–165, 5 refs. Delhi, 1943. [Recd. 1945.]

The observations recorded in this paper were carried out in 1938–40 at Mukteswar, United Provinces. Larvae of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) took 8–60 mins. to engorge on a rabbit; first-, second- and third-instar nymphs took 15–25, 25–35 and 35–45 mins., respectively; and fourth- and fifth-instar nymphs 45–60 mins. Females took 20–150 mins. to complete their first full feed, the average time being one hour. They either refused to feed again or engorged only partly. Pairing usually occurred shortly after the feed, but occasionally before it. Eggs were laid in batches, at intervals of a few days, over periods of 4–5 or sometimes even 8 months. Oviposition generally began in January or February and was resumed the following season at the same time. The average number of eggs laid by one female was 681·5 at 21°C. [69·8°F.] and 700 at 25°C. [77°F.], and the percentages that were fertile at these temperatures were 81·65 and 74·35. The intervals between pairing and the commencement of oviposition were 23 and 21·5 days. The average length of life of fed females was 620 days at 21°C. and 543 days at 25°C., and that of unfed nymphs of each of the first four instars at 25°C. was 213, 251·2, 328 and 369·4 days, respectively. Unfed larvae survived for a maximum of 52 days at 25°C. The average durations

of the incubation period and the larval and first nymphal stages (counted from the first feed in each case) were 19·6, 14·7 and 18·2 days, respectively, and the average length of the later instars was usually between 20 and 30 days. Males emerged after 4–5 moults and females after 4–6 or rarely 7. The mean minimum period from egg to adult was 96 or 124 days in males and 95, 120 or 160 days in females, according to the number of moults.

SAPRE (S. N.). **Some Methods of feeding Ticks.**—*Indian J. vet. Sci.* **13** pt. 2 pp. 175–177, 11 refs. Delhi, 1943. [Recd. 1945.]

Various methods of feeding ticks are reviewed from the literature, and accounts are given of the technique found most satisfactory by the author in his studies of the life-histories of common Indian species. Difficulty was experienced chiefly in the case of intermittent feeders, and capsules resembling those described by F. A. Morton in a paper already noticed [*R.A.E.*, B **17** 124] were found useful for these. Those used on bullocks are of iron or tin, 3 ins. in diameter and $\frac{1}{2}$ in. deep with a rim about $\frac{1}{4}$ in. wide all round. A circular piece 1 in. in diameter is removed from the top and replaced by copper gauze to admit air. To allow the ticks to attach themselves, they are confined to the shaved skin under a piece of linen, before the capsule is applied and the animal is prevented from interfering with the capsule by means of a neck-rack. The capsule can be removed daily and the engorged ticks removed. Wooden capsules 2 ins. in diameter and $\frac{1}{4}$ in. in depth and in thickness of wall, with small holes bored in them to admit air, are substituted for metal ones for feeding on dogs and goats, a coat specially prepared to prevent scratching and a leather or cardboard collar being necessary on the former. To feed Argasid ticks on rabbits, the animal is tied on a board with a neck collar. The ticks are collected in a petri dish, which is inverted over a shaved area on the abdomen and held in place with a bandage. The bandage is removed after about half an hour and the engorged ticks collected. Adults of *Argas persicus*, Oken, are fed on fowls in large glass jars with metal lids having the centre area fitted with gauze to admit air. The fowl, with its head in a cloth bag, is placed with the ticks on a perforated platform and left overnight.

HAMID KHAN. **On the relative Value of certain larvivorous Fishes from the Punjab, with Notes on their Habits and Habitats.**—*Indian J. vet. Sci.* **13** pt. 4 pp. 315–325, 23 refs. Delhi, 1944.

The following is mainly based on the author's summary. *Colisa lalia*, *Ambassis baculis* and *Barbus sophore*, three larvivorous fish of the Punjab, were observed in captivity to devour 148, 136 and 90 mosquito larvae per fish per day, respectively. A study of their gut contents indicated that *C. lalia* and *A. baculis* invariably feed on mosquito larvae when put into a reservoir where these are present. In the absence of mosquito larvae, they feed on Crustacea, rotifers and the larvae of aquatic insects. Though *B. sophore* fed actively on mosquito larvae in the laboratory, in ponds it mostly feeds on mud, decayed vegetation, algae and aquatic weeds, and thus reduces the food-supply of mosquito larvae. All three species bred successfully in reservoir water. Only *C. lalia* survived in a mixture of equal parts of reservoir water and sewage water, but all could thrive in such stagnant waters as lie near towns and villages. Notes are given on their breeding habits. All need sub-surface vegetation, especially in July and August, to enable them to lay eggs. The investigations made have demonstrated the effectiveness of *C. lalia* and *A. baculis* in destroying mosquito larvae in reservoirs and ponds, and their use is recommended. It is calculated that to free water of mosquito larvae as quickly as possible, a population of 2,500 fish per acre of water is necessary.

Emmel (M. W.). **So-called Tick Paralysis in Chickens.**—*J. Amer. vet. med. Ass.* **106** no. 815 p. 108, 3 refs. Chicago, Ill., 1945.

During the past five years, a condition that has been called tick paralysis has been observed in the United States associated with infestation by *Argas persicus*, Oken, in 14 flocks of fowls. It arises irrespective of the age of the birds and has been found associated with all feeding stages of the tick, and sometimes in the presence of relatively few ticks. The reason for its occurrence in some infested flocks and not in others is not known. The symptoms, which do not usually develop for 7–8 days after infestation has occurred, are more those of general weakness than of true paralysis. Illness usually lasts 24–72 hours, and the rate of mortality is often high. Removal of the ticks is followed by extremely rapid recovery. The condition in question may at times be confused with true fowl paralysis, but it is much more rapid in its course and frequently affects a much higher percentage of birds. With reference to the experiments from which Brown & Cross concluded that *A. persicus* is probably an agent in the transmission of fowl paralysis [*R.A.E.*, B **29** 135–136], the author considers that the possibility that tick paralysis and not fowl paralysis was involved was not sufficiently carefully eliminated to warrant the conclusion drawn.

Cuckler (A. C.) & Alicata (J. E.). **The Life History of *Subulura brumpti*, a cecal Nematode of Poultry in Hawaii.**—*Trans. Amer. micr. Soc.* **63** no. 4 pp. 345–357, 23 figs., 7 refs. Menasha, Wis., 1944.

A detailed account is given of investigations in Hawaii on the life-history of *Subulura brumpti*, a caecal parasite of domestic fowls and turkeys that utilises certain insects as its intermediate hosts [*cf. R.A.E.*, B **29** 15; **32** 69]. All stages of this Nematode are described, and its systematic position discussed. The intermediate hosts naturally infested and infested experimentally [*cf. loc. cit.*] are listed; the latter include *Oxya chinensis*, Thnb. No infestation with the infective encysted third-stage larvae was found or could be induced in examples of *Periplaneta americana*, L., *Pycnoscelus surinamensis*, L., *Nauphoeta cinerea*, Ol., *Porcellio laevis*, Latr., *Orchestia platensis*, Kröyer, or adults or larvae of *Musca domestica*, L., collected in poultry yards. When third-stage larvae were fed to chickens, they were recovered from the caeca after 24 hours; the first eggs were found in the caecal droppings of the birds 42 days after they became infested. Histopathological study of sections of the caecum indicated that *S. brumpti* does little harm to the tissues.

Iriarte (D. R.). **Investigaciones parasitológicas y entomológicas sobre la enfermedad de Chagas.** [Parasitological and entomological Investigations on Chagas' Disease.]—*Bol. Lab. Clin. Luis Razetti* **1** no. 3 pp. 45–64, 11 figs. Caracas, 1941. [Recd. 1945.]

The results are given of a survey carried out in various parts of Venezuela for Triatomid bugs and evidence of the presence of Chagas' disease, caused by *Trypanosoma* (*Schizotrypanum*) *cruzi*, of which the principal vector there is *Rhodnius prolixus*, Stål. Examples of this Triatomid were taken in various States, and some of them were found to be infected. One dead example of *Panstrongylus geniculatus*, Latr., was also found infected, but attempts to demonstrate the trypanosome in man, dogs, cats, armadillos, bats and various birds were unsuccessful. Laboratory observations made in the course of rearing *Triatoma* (*Eutriatoma*) *maculata*, Erichs., *R. prolixus* and *Psammolestes arthuri*, Pinto, are recorded, and the original description of the last-named is quoted, supplemented by a full description by the author. In experiments in which *R. prolixus* and *T. maculata* were allowed to feed on infected laboratory animals, both became infected with *Trypanosoma cruzi*, but neither with *T. venezuelense* [*cf. R.A.E.*, B **17** 49]. Laboratory cultures of Triatomids were attacked by ants of various species, a list of which is given, and it is suggested that this fact might be made use of in biological control.

Briceño Rossi (A. L.) & Iriarte (D. R.). **Estudios sobre epizootia aviaria (espiroquetosis gallinacea).** [Studies on an Avian Epizootic (Fowl Spirochaetosis).]—*Bol. Lab. Clin. Luis Razetti* **2** no. 7 pp. 121–127, 4 figs. Caracas, 1942. [Recd. 1945.]

Notes are given on two outbreaks causing mortality among domestic fowls in different localities in Venezuela. They were investigated in December 1941, and both were considered to be due to spirochaetosis caused by *Spirochaeta anserina*. In the first, this spirochaete was observed in the blood of one sick bird, and hundreds of engorged examples of *Argas persicus*, Oken (*miniatus*, Koch) were found on the wooden walls of the fowl-house. Attempts to demonstrate the spirochaete in the ticks and their coxal fluid, however, were unsuccessful. In the second, in which about 200 birds had died in two years, ticks identified by Ewing as *A. persicus* were common on the trunks of the trees on which the fowls roosted, but experiments failed to demonstrate the presence of spirochaetes in them or in an affected fowl that died soon afterwards. A further outbreak was subsequently reported.

Briceño Rossi (A. L.) & Iriarte (D. R.). **Breves notas sobre últimas investigaciones verificadas en las zonas pintógenas de Venezuela en relación al estado actual del conocimiento del carate o mal del pinto.** [Brief Notes on recent Investigations in Regions of Venezuela where Carate occurs, in Relation to present Knowledge of Carate or "Mal del Pinto."]—*Bol. Lab. Clín. Luis Razetti* **4** no. 13 pp. 221–235, 2 figs., 52 refs. Caracas, 1944.

In the course of this paper on various clinical aspects of the disease in man known in Venezuela as carate or "mal del pinto," which is caused by *Spirochaeta* (*Treponema*) *caratea* [*cf. R.A.E.*, B **32** 125], the authors state that several laboratory animals proved non-susceptible to infection and that infection could not be demonstrated in various domestic animals in foci of the disease, so that it seems unlikely that it has an animal reservoir. Examination of patients showed that lesions were far the commonest on exposed parts of the body. Carate and yaws conferred no protection against each other. The spirochaete could not be demonstrated in Simuliids, including *Simulium exiguum*, Roub. [*cf. loc. cit.*] collected in foci of the disease or allowed to feed on infective material, and a communication from P. J. Anduze recording a similar failure is quoted. Against the theory that the disease is transmitted by these flies [*cf.* **32** 222], it is noted that Simuliids in captivity died within 72 hours. Further investigations are to be carried out to ascertain whether mosquitos, ticks, *Phlebotomus* or other Arthropods play any part in transmission.

Iriarte (D. R.). **Sobre una nueva especie de flebótomo en el país : *Flebotomus* (*Brumptomyia*) *suis*, Rozeboom 1940.** [*Phlebotomus suis*, a Species new to Venezuela.]—*Bol. Lab. Clín. Luis Razetti* **4** no. 15 pp. 268–273, 275, 5 figs., 18 refs. Caracas, 1944.

Sandflies collected by the author in Venezuela included *Phlebotomus suis*, Rozeboom, which had not previously been recorded from that country. Its original description [*R.A.E.*, B **28** 218] is quoted, and a list is given of 12 other species of the genus that occur in Venezuela [*cf.* **32** 216].

Vargas (L.). *Culicoides diabolicus* **en México. Caracteres del macho.** [Characters of the Male.]—*Rev. Inst. Salub. Enferm. trop.* **5** no. 3 pp. 163–167, 2 pls., 10 refs. Mexico, D.F., 1944.

From material collected in Chiapas, Mexico, the author describes the hitherto unknown male and the terminalia of the female of *Culicoides guttatus*, Coq., var.

diabolicus, Hoffman [*cf. R.A.E.*, B **27** 228], which he treats as a distinct species, though agreeing with Costa Lima in a paper already noticed [**26** 80] that it differs from *C. guttatus* only in wing measurements, and considers that *C. filariferus*, Hoffman [**28** 106] is a synonym of it. The range of var. *diabolicus* apparently extends from southern Mexico to Panama and perhaps into the north-west of South America, while the typical *C. guttatus* occurs in the States of Rio de Janeiro, São Paulo and Bahia, Brazil. *C. venustus*, Hoffman, another related species, is a nearctic form known from Maryland, Connecticut and New York.

Howell (D. E.) & Fenton (F. A.). **The Repellency of a Pyrethrum-Thiocyanate Oil Spray to Flies attacking Cattle.**—*J. econ. Ent.* **37** no. 5 pp. 677–680, 2 figs. Menasha, Wis., 1944.

An account is given of experiments carried out in Oklahoma from May to early September 1942 on the effect of spraying cows for the control of flies. The spray used contained a proprietary pyrethrum concentrate and two proprietary preparations of organic thiocyanates in a base oil at concentrations equivalent to 0·4 gm. pyrethrins and 20 cc. thiocyanates, chiefly butyl carbitol thiocyanate, per 1,000 cc. oil. It was applied to cover all parts of the cow, including feet and legs. The following is based on the authors' conclusions. Applied at rates of 0·5, 1 and 2 cc. per 3·23 sq. ft. of body surface, the spray was repellent to *Lyperosia* (*Haematobia*) *irritans*, L., for periods of up to 10·5 hours, but repellency against *Stomoxys calcitrans*, L., was nearly always less, and little remained 4–5 hours after spraying. In parallel tests, 2 cc. spray per 3·23 sq. ft. was more repellent to *L. irritans* than 0·5 cc. for 7 hours after the morning sprayings. No significant differences were noted at other times. The heavier application was more repellent to *S. calcitrans* only for 4 hours after morning spraying and 2 hours after evening spraying. *L. irritans* was more plentiful in the morning than during the afternoon, but *S. calcitrans* was most abundant in the evening.

Simmons (S. W.). **Observations on the Biology of the Stablefly in Florida.**—*J. econ. Ent.* **37** no. 5 pp. 680–686, 7 refs. Menasha, Wis., 1944.

The results are given of tests and observations on the development and feeding habits of *Stomoxys calcitrans*, L., made in Florida in 1939–42 during investigations on its breeding places and control [*R.A.E.*, B **30** 60; **31** 95, 100]. The minimum and maximum incubation periods at 28°C. [82·4°F.] were 19 and 120 hours, and the calculated arithmetic mean was 52·3 hours. The percentage hatch was 30·45. At 30°C. [86°F.] in Richardson's medium as modified by Doty [**25** 206, etc.], first- and second-instar larvae were found 1–80 and 44–144 hours, respectively, after hatching, and third-instar larvae after 97 hours. Pupation sometimes occurred 148 hours after hatching. Development took longer during mid-winter, even at summer temperatures. It was as rapid in fresh deposits of *Thalassia testudinum* and *Holodule wrighti* as in Richardson's medium. The mean minimum pupal period for 49 lots was 6·55 days at 28–32°C. [82·4–89·6°F.]. It was only 5·8 days during April, May and June, and the period was longest during mid-winter. The maximum length of life in captivity of adults taken in nature and fed on citrated beef blood was 47 days, but most of them died in much less time. The minimum pre-oviposition period observed was 8 days, and the mean of 23 lots was 10·6 days. In tests on goats, adults often punctured the skin several times before drawing blood, but engorged in 1½–8 minutes when blood was found. Under semi-field conditions in south-western Florida, the flies fed on man more readily early in the morning and late in the afternoon than during the mid-day heat.

Deposits of *T. testudinum* and *H. wrighti* isolated for 7, 14 and 21 days before flies were allowed to oviposit on them produced 33·61, 19·91 and 3·21 per cent. as many flies, respectively, as did deposits infested while fresh. Uninfested deposits 21 days old or more need not be treated to prevent subsequent breeding. Third-instar larvae overwinter in ground-nut litter in north-western Florida [*cf.* **30** 61] and to a smaller extent in dung mixed with hay or grain. Slow development occurs throughout the winter and great numbers of flies emerge during warm periods.

Bruce (W. G.). **Screwworm Survey of the south-eastern States in 1943.**—*J. econ. Ent.* **37** no. 5 pp. 687–689, 1 fig. Menasha, Wis., 1944.

A survey of the incidence of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) in the south-eastern United States in 1943 revealed widespread infestations in Florida, Georgia and Alabama. Those in peninsular Florida and southern Georgia reached outbreak proportions with a considerable loss of livestock (chiefly cattle). Only a few scattered infestations were found in Mississippi and Tennessee and in one county of South Carolina, and none in Kentucky. The factors contributing to the rapid rise in the population of *C. hominivorax* and its spread in the south-east were favourable climatic conditions in the preceding winter and spring, shortage of experienced farm labour and the unavailability of effective remedies. As a result of the survey, the proper distribution and conservation of insecticides was ensured, infestations were greatly reduced, and stockmen acquired a knowledge of the use of the effective dressing [*cf. R.A.E.*, B **33** 23].

Shull (W. E.). **Idaho Recommendations for Insect Control.**—*Bull. Idaho agric. Exp. Sta.* no. 252, 63 pp. Moscow, Idaho, 1944.

This bulletin consists chiefly of an annotated list of insects and mites, arranged under their popular names, that are injurious in Idaho. It includes some that attack domestic animals, livestock and poultry, or that are household pests. The notes comprise information on their appearance, habits and control, and a list showing the scientific names of the pests is appended.

Echavarría A. (C.). **Parásitos de los animales domésticos.**—*Rev. Fac. nac. Agron.* (*Colombia*) **5** no. 18 pp. 233–295. Medellín, 1942. [Recd. 1945.]

This is an annotated list of some organisms that attack domestic animals in Costa Rica. They are arranged systematically under their hosts (cattle, horses, pigs and birds) and include some insects and parasites transmitted by insects. The notes include information on morphology, life-history and remedial treatments.

Papers noticed by Title only.

Puri (I. M.). **A Practical Entomological Course for Students of Malariology.**—*Hlth Bull.* no. 18 (*Malar. Bur.* no. 9) 3rd edn. revd., x+189 pp., 168 figs., 102 refs. Delhi, Manager of Publications, 1942. Price 2*s.* 6*d.* [Recd. 1945.] [*Cf. R.A.E.*, B **23** 97; **29** 136.]

Swisher (E. M.). **The Toxicity of Sulfur Dioxide, Acetone and Ethylene Oxide alone and in Combination.**—*J. econ. Ent.* **37** no. 5 pp. 690–693, 3 figs., 6 refs. Menasha, Wis., 1944. [*Cf. R.A.E.*, B **33** 13.]

Swisher (E. M.). **Sulphur Dioxide-Acetone as a Household Fumigant.**—*J. econ. Ent.* **37** no. 5 pp. 694–697, 1 fig., 8 refs. Menasha, Wis, 1944. [*Cf. R.A.E.*, B **33** 14.]

POTEMKINA (V. A.). **Contribution to the Study of the Development of *Thysaniezia ovilla* (Rivolta, 1878), a Tapeworm Parasite of Ruminants.**—*C.R. Acad. Sci. URSS* (N.S.) **43** no. 1 pp. 43–44, 1 fig. Moscow, 1944.

An account is given of investigations carried out in the laboratory in Moscow in 1940–41 showing that the sheep tapeworm, *Thysaniezia ovilla*, of which the developmental cycle was not well known, is able to utilise the Oribatid mites, *Scheloribates laevigatus*, Koch, and *S. latipes*, Koch, as its intermediate hosts [*cf. R.A.E.*, B **31** 85]. Its development to the infective stage in *S. laevigatus* is described. Oncospheres were present about 2 days after the mites had become infected with the eggs of the Cestode, and cysticercoids with incompletely developed scolices were present after 120–140 days at 17–19°C. [62·6–66·2°F.] and 80–90 days at 26°C. [78·8°F.]; mature cysticercoids were present after 130–150 days.

When two three-day-old lambs were fed on gelatine capsules containing examples of *S. laevigatus* and *S. latipes*, harbouring cysticercoids of *T. ovilla*, no eggs or segments of the Cestode were detected in their droppings 15–25 days later, but when the lambs were dissected on the 25th day, their small intestines were found to contain one and two sexually immature examples of *T. ovilla*, respectively.

COOLEY (R. A.). *Ixodes ozarkus* **n. sp. and** *Ornithodoros aquilae* **n. sp., with Notes on** *O. talaje* and *O. kelleyi* **(Ixodoidea).**—*J. Parasit.* **30** no. 5 pp. 287–294, 3 figs., 3 refs. Lancaster, Pa., 1944.

The adults of both sexes of *Ixodes ozarkus*, sp. n., are described from material collected on deer and dogs in Arkansas in 1944 and the adults, nymph and larva of *Ornithodoros aquilae*, sp. n., from material taken on various birds of prey in Wyoming and Colorado in 1943 and 1944. *I. ozarkus* attacks man readily and is difficult to remove, and the effects of its bite persist longer than those of the bite of the common dog tick [*Dermacentor variabilis*, Say]. It is very active, attaching to hunting dogs in large numbers in December, January and February. Brief notes are given on the distinguishing characters of *I. ozarkus*, *I. scapularis*, Say, and *I. affinis*, Neum., and fuller ones, with illustrations, on those of *O. aquilae*, *O. talaje*, Guér., and *O. kelleyi*, Cooley & Kohls, which are closely related. It is thought that some of the distributional records of *O. talaje* may be found to be based on misidentifications.

BOVINGDON (H. H. S.) & COYNE (F. P.). **Trichloracetonitrile as a Fumigant.**—*Ann. appl. Biol.* **31** no. 3 pp. 255–259, 4 refs. London, 1944.

Most of the tests described in this paper were carried out on pests of stored products [*cf. R.A.E.*, A **33** 295], but the toxicity of trichloracetonitrile to *Cimex lectularius*, L., and *Musca domestica*, L., was also investigated. In laboratory tests in which the former was exposed for five hours at 20°C. [68°F.] to concentrations of 1·2, 3·3, 5·8 and 8 mg. per litre [equivalent to oz. per 1,000 cu. ft.], the percentage mortalities a week later averaged 0, 11, 59, and 100, respectively; that among the controls was 10. Toxicity was increased somewhat by the addition of 10 per cent. (by volume) of carbon dioxide. The concentrations of hydrocyanic acid gas necessary to give mortalities of 50 and 99 per cent. were estimated to be 0·11 and 0·33 mg. per litre, respectively. In laboratory tests in which adults of *M. domestica* were exposed for 1 hour at the same temperature, concentrations of at least 4 mg. per litre gave complete mortality. When the fumigant was applied at rates of 6·4 and 3·5 mg. per litre by means of an Aerograph spray gun at a pressure of 15 lb. per sq. inch in an almost empty room in which flies had just been released, complete mortality was given

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by exposures of 1 and 2 hours, respectively. When the flies were released immediately after spraying and exposed for 1 hour, the percentage mortalities and (in brackets) the percentage knock-down were 56 (100) and 92 (99) in two tests in which the rate of application was 4·3 mg. per litre and 100 (100) when it was 8·6 mg. The fumigant could not be detected after the room had been ventilated for ten minutes. Since the product of concentration and period of exposure required for complete mortality in the laboratory had only to be doubled to give effective results in the large-scale tests, it is concluded that little absorption takes place.

Trichloracetonitrile may not be of much practical use against house-flies, but it might prove useful in fumigating domestic property infested with *C. lectularius* [*cf.* B **31** 69], since it is less dangerous than hydrocyanic acid gas, which is at present the most effective fumigant for this purpose.

RAU (P.). **A Note on the Period of Incubation of Eggs of the Cockroach** *Blattella germanica* **L.**—*Canad. Ent.* **76** no. 10 p. 212, 2 refs. Guelph, Ont., 1944.

In twelve observations made in 1939 in Missouri, females of *Blattella germanica*, L., in captivity, were found to carry egg-capsules protruding from their bodies for 6–16 days, with an average of 10 days. In three instances, the eggs hatched while the females were still carrying the egg-capsules. The egg stage, estimated from the time when the capsules first protruded from the body, lasted 11–13 days in eight instances, and the cockroaches hatching from three capsules reached the adult stage in 53, 54 and 56 days. Two females deposited a second capsule 22 and 30 days, respectively, after the first.

MALLIS (A.). **Handbook of Pest Control.**—9×6 ins., 554 pp., 139 figs., 41 pp. refs. [New York, N.Y.] McNair-Dorland Co., Inc., 1945. Price $6.

This book on the life-history and control of household pests is intended primarily for pest-control operators in the United States. It is based on recent investigations and is a very serviceable work, the value of which is increased by the numerous references to the very extensive and classified bibliography. The greater part deals with Arthropods that damage the structure or contents of houses and those that attack man or may be otherwise injurious to health. In addition to species that are primarily and constantly pests in dwellings, however, they include many that are only occasionally or accidentally troublesome in or near them. There are two final chapters on chemical control and house fumigation.

MILLER (A. W.). **Report of the Chief of the Bureau of Animal Industry, Agricultural Research Administration, 19** [43–] **44.**—48 pp. Washington, D.C., U.S. Dep. Agric., 1944.

Work on the eradication of *Boophilus annulatus*, Say, by inspections and dipping of cattle, horses and mules was continued in the United States in the year ended 30th June 1944 [*cf. R.A.E.*, B **33** 49]. The area released from quarantine was extended and now includes the whole of Florida. Dipping was resumed in Porto Rico, where the tropical variety of the tick, *B. a. microplus*, Can. (*australis*, Fuller), is prevalent, and it was necessary to treat sheep and goats.

A severe outbreak of anaplasmosis occurred in Kansas. The evidence indicates that it began after the introduction of carrier cattle into the State during the summer months when Tabanids were prevalent [*cf.* **33** 10]. During the year, 337 cattle infested with cattle grubs [*Hypoderma*] were treated experimentally

with dusts containing rotenone [*cf.* **33** 128] in Colorado, New Mexico and Texas. Cubé powder mixed with tripoli earth and other carriers was applied to the backs of cattle at the rate of 2–3 oz. per animal; the percentages of larvae killed ranged from 21 to 92, with an average of 60, and increased as the season advanced and the larvae grew older. Tripoli earth was the most effective of the carriers used and sulphur the least. Dusts were slower in action than washes or dips, which caused a consistent mortality of 90 per cent. or more.

Nicotine adsorbed on bentonite (fixed nicotine) was tested in dips at the rate of 2 lb. per 100 U.S. gals. water for the control of the sheep "tick" [*Melophagus ovinus*, L.]. Wettable sulphur was sometimes added at the rate of 10 lb. per 100 U.S. gals., but it did not enhance the effectiveness of the dip. In New Mexico, 2,400 infested range sheep were dipped once. A few live adults of *M. ovinus* were seen two hours later, a few live adults, many live pupae and many dead adults were found 13 days after dipping, and subsequent inspections 34, 60 and 90 days after dipping showed progressively increasing numbers of live adults and pupae. In Colorado, 793 farm ewes and lambs were dipped once in a small portable vat with a capacity of 200 U.S. gals. and a suitable draining pen. Only occasional live adults were found eight days later, but after 30, 60 and 90 days the numbers of live adults and pupae were found to be slowly increasing, and nine months after dipping the infestation had assumed its original proportions. The dip was harmless at the concentration used, and although it did not effect complete control, as did a single dipping with derris or cubé [*cf.* **32** 65], it offers a means of temporarily reducing infestation when powders containing rotenone are unobtainable.

UNDERHILL (G. W.). **Blackflies found feeding on Turkeys in Virginia** (*Simulium nigroparvum* **Twinn and** *Simulium slossonae* **Dyar and Shannon**).—*Tech. Bull. Virginia agric. Exp. Sta.* no. 94, 32 pp., 15 figs., 5 refs. Blacksburg, Va., 1944.

The two Simuliids known to attack turkeys in Virginia are *Simulium nigroparvum*, Twinn, which transmits *Leucocytozoon smithi*, and *S. slossonae*, Dyar & Shann. [*R.A.E.*, B **26** 189; **28** 173]. A survey of their possible breeding places was made between 1935 and 1941, inclusive, and adults were also collected. The larvae, pupae, cocoons and adults of both sexes of the two species are described in detail, and notes are given on their distribution, life-history and habits. Much of the information on *S. nigroparvum* has already been noticed [*cf.* **26** 189; **29** 134]. It was found in 37 streams in 28 counties, principally in the mountain and foothill region. It appeared to have a life-cycle lasting about six weeks and at least three generations during the season. *S. slossonae* was taken in four counties in the Coastal Plain region and was found breeding in four streams, generally along or just above the line where fresh and brackish water meet. These streams were small, 3–10 ft. wide and 8–15 ins. deep, with bottoms of sandy mud and a current of 1½–2 ft. per second and considerable plant growth and shade. Immature stages were collected from 23rd March to 6th November. There were indications that maximum adult emergence takes place in summer and early autumn. The general behaviour and feeding habits of this species appeared to be the same as those of *S. nigroparvum*.

Entomological Investigations.—*17th Rep. Coun. sci. industr. Res. Aust. 1942-43* pp. 15–20. Canberra, 1944.

Entomological Investigations.—*18th Rep. Coun. sci. industr. Res. Aust. 1943–44* pp. 14–20. Canberra, 1944.

During the years 1942–44, work on medical entomology was considerably extended, and some of the results obtained are given in the second report. Oils

of *Backhousia myrtifolia*, *Zieria smithii*, *Melaleuca bracteata* and Huon pine (*Dacrydium franklinii*), which had been found in the previous year to be effective mosquito repellents, were also most effective as activators for pyrethrins in sprays against flies but not against mosquitos. Oil of *B. myrtifolia* was many times superior to sesame oil [*R.A.E.*, B **31** 148]. Fly-sprays containing 0·03 per cent. DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] were highly toxic to house-flies [*Musca domestica*, L.], but their knockdown effect was slow. This can be remedied by the addition of small quantities of pyrethrum. Surfaces treated with DDT were found to kill house-flies resting on them for at least nine months. Sodium arsenite at the rate of ½ lb. in 3 gals. water per 10 cu. ft. of kitchen refuse gave complete kill of fly larvae.

Work on the bionomics of the cattle tick [*Boophilus annulatus microplus*, Can.] was continued in both years. In the second, it was found that the period for which the larvae can survive increases with increasing humidity until saturation point is almost reached. Newly emerged nymphs and adults experimentally transferred from one host to another reached maturity. The maximum parasitic period for males was about 70 days and the maximum, minimum and mean parasitic periods for females were 35, 18·9 and 22·9 days, respectively [*cf.* **32** 81]. The natural mean mortality of parasitic stages in the field was determined as 26·2 per cent. Nymphs and adults migrate freely following ecdysis before becoming attached, and unfavourable conditions promote this movement. Bacteriological studies showed that the oxidation of sodium arsenite to sodium arsenate in used dips is due to an active system, which can be destroyed by autoclaving or by the use of bacteriostatic agents. In the laboratory, oxidised dips tended to reduce when contact with air was prevented. Spraying with arsenical solutions at intervals of a fortnight allowed some females of *Boophilus* to engorge and lay viable eggs, apparently because of the resistance shown by the early nymphal stage. When spraying was carried out at intervals of a week, no ticks developed beyond the unengorged nymphal stage. Some unattached larvae survived treatment with arsenic. These larvae had been shown in the previous year to be much more difficult to kill with arsenic than the parasitic stage. Also the use of salt water in the dip had not increased its toxicity, and an investigation into the reputed existence of a strain of the tick resistant to arsenic [*cf.* **31** 122 ; **32** 81] had failed to yield conclusive evidence. Arsenic gives practically no protection against reinfestation. Promising results were obtained in tests with sprays of DDT in 1943–44, the most susceptible stages being the larva and newly emerged adult and the least susceptible the semi-engorged nymph. Protection against reinfestation varied from 2 to 13·5 days with concentrations varying from 0·5 per cent. DDT in alcohol to 2 per cent. in emulsion.

In the first report, it is recorded that *Lyperosia exigua*, de Meij., has spread down the east coast of Queensland as far as Townsville [*cf.* **31** 122]. Research into its control was carried out in 1943–44. The use of a roofed passage about 11 ft. long, 6 ft. high and 3 ft. wide, built into the fence of the milking yards and containing curtains to brush the flies off the cows passing through and traps in the sides to collect them [*cf.* **26** 248], reduced the number of flies per cow to less than 10 per cent. of what it had formerly been. The worry caused by the few remaining ones was negligible. Herds in which all the animals were sprayed with a 4 per cent. solution of DDT in kerosene remained practically free from flies for 2–3 weeks. Flies settling on the hide after this were not killed, but the population did not reach the pre-treatment level for a further two weeks. Economy of DDT and labour could be effected by not spraying the parts of the hide normally kept free of flies by the switching of the tail, by treating only about half the herd, including the most attractive animals, or by treating only those parts of the animal on which the flies settle most, namely the shoulders and flanks. Kerosene is injurious to the skin of cows if applied in sufficient quantity. An aqueous emulsion of kerosene solution of DDT incorporating a

proprietary wetting agent showed considerable promise and enabled the quantity of kerosene applied to be substantially reduced. However, the research that has been done does not make it yet possible to recommend DDT for general use against *L. exigua*.

Malone (R. H.) & Brooks (A. G.). **Transmission of Kala-azar in India. The Case against the Sandfly.**—*Indian med. Gaz.* **79** no. 10 pp. 484–493, 45 refs. Calcutta, 1944.

From a review of the experiments and observations that have led many to consider that visceral leishmaniasis (kala-azar) is transmitted in India by the bite of *Phlebotomus argentipes*, Ann. & Brun., the authors conclude that the evidence is against insect transmission. The main grounds on which they base this conclusion are: the apparently short life of *P. argentipes* in nature, the highly artificial conditions under which transmission by it was effected in the laboratory [*R.A.E.*, B **31** 143], where the sandflies had their life prolonged, were induced to take more than one blood-meal and had been "blocked" by special conditions of rearing and feeding; the experimental transmission of kala-azar by ingestion and proximity; the fact that it cannot be considered a disease of the blood stream and the failure of the flagellates to survive when injected into the blood stream [*cf.* **11** 155]; the unsatisfactory nature of the evidence that the distribution of the disease and the sandfly coincide; the difficulty of explaining the erratic manner in which the disease spreads, if it has a vector with a short range of flight, and its failure to spread in schools and hospitals although it is a house disease; and the tendency for it to occur more often in males than females, in Anglo-Indians, Indian Christians and Mohammedans than in Hindus and in persons 6–20 years old than in those in other age groups. They consider that the life-history of *P. argentipes* precludes it from being the natural vector of any human disease and that the old theory that intimate contact is necessary for the transmission of kala-azar should be further investigated, together with the significance of abrasions, constant sweating and lack of personal cleanliness.

De Meillon (B.) & Lavoipierre (M.). **New Records and Species of biting Insects from the Ethiopian Region.**—*J. ent. Soc. sthrn Afr.* **7** pp. 38–67, 5 figs., 4 refs. Johannesburg, 1944.

This paper includes a list of the Ethiopian species of *Phlebotomus* with references that are important for identification, new records for four species, and descriptions of one new variety and two new species, including *P. rossi*, which belongs to the group of *P. major*, Annan., and was taken in a stable in Southern Rhodesia [*R.A.E.*, B **33** 117]. A method of preparing *Phlebotomus* for identification is described. There are also records of *Anopheles obscurus* var. *nowlini*, Evans, and *A. rufipes* var. *ingrami*, Edw., from the Belgian Congo and *A. listeri*, De Meillon, from Southern Rhodesia, and of mosquitos of other genera from the Belgian Congo, Northern Rhodesia, Southern Rhodesia, South West Africa and Cape Province, with descriptions of new species from the Belgian Congo and Northern Rhodesia. The Ceratopogonid, *Culicoides hirtius*, sp. n., is described from the Transvaal.

Five new species of mites are also described. Many nymphs and females of *Dermanyssus gallinae*, Deg., were taken from a fowl run in Johannesburg in 1943, and R. F. Lawrence records this mite as attacking man in Cape Town. Records are given of *Liponyssus bacoti*, Hirst, taken on rats trapped almost daily from 10th November to 10th December 1943 in Johannesburg, where this species was causing dermatitis in man. The mites taken on these rats included 77 individuals of a new species described here as *L. latiscutatus* [*cf.* **33** 117]. Mites attacking troops embarking horses at a South African port were identified as *L. bursa*, Berl.

Olzscha (R.). **Mitteilung über das Vorkommen von** *Anopheles maculipennis* **im Warthegau, mit Angabe einer einfachen Methode der Blutfütterung von Mücken bei ihrer Haltung in Einzelhaft.** [Contribution on the Occurrence of *A. maculipennis* in the Warthegau, with a Description of a simple Method for feeding Blood to Mosquitos when kept in Isolation.]—*Zbl. Bakt.* (I Orig.) **150** pt. 4 pp. 215–217. Jena, 1943. [Recd. 1945.]

In view of the risk of local outbreaks of malaria following the settlement of German nationals from south-eastern Europe in north-western Poland (the so-called Warthegau), a survey was begun in March 1941 to ascertain the varieties of *Anopheles maculipennis*, Mg., present in that region. Hibernating females were collected from suitable sites in 221 localities and taken to Berlin, where they were kept singly in lamp-glasses at room temperature and fed on a mixture of pig's blood and water (2 : 1) sweetened with sugar and offered to them on cotton-wool. They fed and oviposited readily. Of the 600 egg-batches investigated, all except one that belonged to var. *atroparvus*, van Thiel, and a few that could not be identified with certainty, proved to be var. *messeae*, Flni. This agrees with the observation that the hibernating females were rare in houses and animal quarters but common in unheated and uninhabited buildings.

Burgess (R. W.) & Young (M. D.). **Methods of handling and feeding** *Anopheles quadrimaculatus* **Say upon malarious Patients.**—*J. nat. Malar. Soc.* **3** no. 4 pp. 241–247, 3 figs. Tallahassee, Fla., 1944.

Small glass jars with the ends covered with bobbinet secured by rubber bands were used for feeding large numbers of females of *Anopheles quadrimaculatus*, Say, on malaria patients. From one to five mosquitos (preferably one) were placed in each jar. The greatest proportion fed when 49–72 hours had elapsed since emergence, when the females had had an opportunity of feeding daily on sugar solution until within 12 hours of the blood-meal and when they had had the opportunity to mate. Room temperature changes within the range of activity of the mosquito had little effect, but feeding was slightly stimulated by reducing the intensity of light. The procedure adopted was to collect pupae daily about 9 a.m. and place them in a ½-pint cardboard container under a bobbinet-covered lantern globe for emergence, which usually began after about 30 hours and continued for a similar period. Pads soaked in a sugar solution such as 5 per cent. dextrose were placed on the jars each evening and removed each morning. When all the mosquitos had emerged, they were transferred for mating to a glass cage (10 × 10 × 15 ins.) with end openings covered with sleeves. The females were removed to the stock cage or the small feeding jars after 24–48 hours. Once placed in the feeding jars, they remained in them until they were removed for dissection.

Reeves (W. C.). **Preliminary Studies on the feeding Habits of Pacific Coast Anophelines.**—*J. nat. Malar. Soc.* **3** no. 4 pp. 261–266, 23 refs. Tallahassee, Fla., 1944.

Precipitin tests for blood of man, horse, cow, sheep, dog, pig and bird in the stomach contents of 473 freshly fed females of *Anopheles maculipennis freeborni*, Aitken, 178 of *A. pseudopunctipennis*, Theo., and 52 of *A. punctipennis*, Say, all collected in farmyards and similar places in the Pacific Coast area of the United States, showed that 3, 0·6 and 3·8 per cent., respectively, had fed on man. The results include a small number that have already been published [*R.A.E.*, B **33** 80]. The greatest number of positive reactions in each species was obtained with cow anti-serum, but in the case of *A. pseudopunctipennis*, 49·4

per cent. of the smears gave no reaction. The area in which the highest proportion (7·1 per cent.) of *A. maculipennis freeborni* was feeding on man was one of the best known endemic foci of malaria in California. The results are thought to indicate that this Anopheline is involved in the transmission of malaria in the Pacific Coast area. *A. pseudopunctipennis* may transmit it in Arizona where it was the only common species of *Anopheles*.

DORER (R. E.). **An outward opening, combination Storm and Screen Door.**—*Publ. Hlth Rep.* **60** no. 5 pp. 132–133, 2 pls., 1 fig. Washington, D.C., 1945.

Screen doors must open outwards if they are to exclude insects satisfactorily. In the United States, storm doors on barracks and public buildings must also open outwards to conform with fire regulations. To meet both requirements, a combined screen and storm door is illustrated. It consists of two units hung on a three-way hinge in such a way that they can swing together or separately.

WEATHERSBEE (A. A.) & BOHART (G. E.). **Observations on the nocturnal Activity of *Anopheles* and certain other Mosquitoes in eastern Puerto Rico.**—*Puerto Rico J. publ. Hlth* **19** no. 4 pp. 626–634, 1 fig., 6 refs. Brattleboro, Vt., 1944. (With a Translation in Spanish pp. 635–642.)

Three successive experiments extending over 34 nights (from 5 p.m. to 6 or 7 a.m.) and comprising 454 hourly observations were carried out in three separate localities of eastern Porto Rico in October-November 1942 and January 1943 to determine the hours of greatest activity of *Anopheles albimanus*, Wied., the principal vector of malaria in the Island. Magoon-type traps [*R.A.E.*, B **23** 302] were used with a horse as bait [*cf. R.A.E.*, B **33** 2]. About two-thirds of the total number of examples of *A. albimanus* taken were caught between 8 p.m. and 3 a.m. In each hour of this period, with one exception, the number entering the traps was greater than the mean number per hour for the 454 hours of the experiments. There did not appear to be any close correlation between numbers of *A. albimanus* caught and rainfall, wind or temperature. The hours of greatest activity seemed to be those least subject to the influence of sunlight. *A. grabhami*, Theo., was taken during each hour of the experiments. Its activity appeared to increase between 5 and 8 p.m., and then to remain more or less constant through the night, but the numbers taken may not have been large enough to indicate trends of hourly activity under conditions of heavy production. *A. vestitipennis*, D. & K., was taken in even smaller numbers, but entered the traps during all the hours of the experiments except before 6 p.m. and after 4 a.m. The catches also included 11 species of mosquitos of other genera. *Culex bahamensis*, D. & K., *C. nigripalpus*, Theo., *C. fatigans*, Wied. (*quinquefasciatus*, auct.), *Aëdes taeniorhynchus*, Wied., and *Psorophora confinnis*, Lynch, the common species in the area, readily entered the traps at all hours of the night.

WEATHERSBEE (A. A.). **A Note on the Mosquito Distribution Records of Puerto Rico and of the Virgin Islands.**—*Puerto Rico J. publ. Hlth* **19** no. 4 pp. 643–645, 3 refs. Brattleboro, Vt., 1944. (With a Translation in Spanish pp. 646–648.)

Records are given of two species of mosquitos recently added to the fauna of Porto Rico [but included in a list already noticed (*R.A.E.*, B **33** 43)], of 14 species in the Island of Vieques, Porto Rico, and of six species in St. John Island, Virgin Islands. The two Anophelines included are *Anopheles albimanus*, Wied., and *A. grabhami*, Theo., which were found on both these Islands.

Levi Castillo (R.). **Clave para la identificación por los órganos masculinos (terminalia) de los principales géneros, subgéneros y especies de anofelinos ecuatorianos.** [Key for the Identification by Means of the male Genitalia of the principal Genera, Subgenera and Species of Anophelines of Ecuador.] —*Rev. méd.* 1944 repr. 14 pp., 10 figs., 8 refs. Quito, 1944.

The methods of preparing the male terminalia of mosquitos for identification are discussed, and a table is given showing Spanish equivalents for the terms used for the various parts of the terminalia by Edwards [*R.A.E.*, B **8** 156], Freeborn [**12** 130] and Christophers & Barraud [**11** 51]. This is followed by keys, based on male genitalia, to the subgenera of *Anopheles* occurring in Ecuador, and to the principal species, which are *A. pseudopunctipennis*, Theo., *A. eiseni*, Coq., *A. apicimacula*, D. & K., *A. punctimacula*, D. & K., *A. mediopunctatus*, Theo., *A. albimanus*, Wied., and *A. neivai*, H., D. & K.

Levi Castillo (R.). **El complejo *pseudopunctipennis* en el Ecuador (Diptera-Culicidae).** [The *pseudopunctipennis* Complex in Ecuador.]—7 pp., 6 figs., 6 refs. Guayaquil, Univ., 1944. (With a Summary in English.)

Anopheles pseudopunctipennis, Theo., is represented in Ecuador by the typical form and one described by the author as var. *levicastilloi*. The eggs and the distinguishing characters of the male genitalia of the two varieties are described. The eggs of the typical form conform to Rozeboom's description [*R.A.E.*, B **26** 40]. A list is given of the districts in which it has been found. They are situated in seven provinces in the mountainous part of the country, in all of which it is the chief or only vector of malaria. The new variety, which has smaller adults, is found from the foot-hills of the Andes to the Pacific in a limited area in the Province of Guayas. It has not been found infected with malaria parasites and is thought to play no part in transmission, the chief vector in the region being *A. albimanus*, Wied.

Levi Castillo (R.). **Estudios sobre los anofelinos de la región del Milagro.**—*Rev. Asoc. Esc. Cien. quim.* **3** no. 1 repr. [16] pp., 13 figs., 1 map, 12 refs. Guayaquil, 1944.

Studies of the mosquito fauna of the region round the town of Milagro in the Province of Guayas, Ecuador, based on collections of larvae and adults, were made between November 1943 and February 1944. The Anophelines found were the typical variety of *Anopheles pseudopunctipennis*, Theo. [*cf.* preceding abstract], *A. punctimacula*, D. & K., and *A. albimanus*, Wied. Keys are given to the larvae and adult females of these species. Breeding continues throughout the year, taking place in the puddles left in the roads in the wet season and in borrowpits by the river and pools in rural areas in the dry season. Many breeding places are near dwellings. Their pH was 7–7·5. The four larval instars and the pupal stages of *A. albimanus* were observed in experiments to last 2, 3 and 2–4 days and 18–48 and 28–34 hours, respectively, and those of *A. pseudopunctipennis*, 2, 3 and 2–3 days and 18–50 and 20–48 hours. *A. punctimacula* was found in the adult stage only. *A. albimanus* with a 3–5 per cent. infection rate is the principal vector of malaria, but it is thought that the other two species play some part in transmission. *A. pseudopunctipennis* is an important vector in the mountains, whence it was brought to Milagro by the railway.

de Andrade (G. C.). **O verde-París na campanha contra o *Anopheles gambiae* no nordeste brasileiro.** [Paris Green in the Campaign against *A. gambiae*, Giles, in north-eastern Brazil.]—*Bol. Ofic. sanit. pan-amer.* **23** no. 3 pp. 210–223, 18 refs. Washington, D.C., 1944.

The larvicide chiefly used in the eradication of *Anopheles gambiae*, Giles, from Brazil [*R.A.E.*, B **32** 159, etc.] was Paris green, and laboratory and field

experiments showed that the most effective type had particles of which the size averaged 2 microns. It caused 82–100 per cent. mortality of first-instar larvae in six laboratory tests. The material contained 62·9 per cent. arsenic trioxide, and the minimum dose required to give complete mortality in 24 hours of 100 larvae in a tank with a surface area of 1 sq. metre and a depth of 18 cm. was 2 mg.

The innovations in the methods of applying Paris green that were introduced by Barber [**24** 289; **28** 195] are described. For dry application, one part Paris green was mixed, usually by hand, with 100 parts unsifted dry sand or dust. Another method was to suspend one part Paris green in two parts kerosene and mix the suspension with damp sand, pebbles or water for application. A list is given of the essential articles in the operator's equipment, which was reduced to a minimum. On the basis of the results of investigations on the life-cycle of *A. gambiae* [**32** 29], the larvicide was applied weekly, except in unusually heavily infested areas, where a cycle of three days was adopted. Both actual and potential foci were treated.

No case of poisoning of man or animals by water treated with Paris green was recorded. Early in the campaign, some of the workers handling the material were affected by it, but as a result of the precautionary measures immediately adopted, accidents were reduced to the minimum. When the Paris green was applied dry, the direction of the wind was observed and the quantity of dust applied adjusted accordingly to its velocity. When wet sand was the carrier, application could be made against the wind. In conclusion, the results obtained in two representative areas from which *A. gambiae* was eradicated in 1939 and 1940, respectively, are given. In one case, Paris green was used alone and in the other in conjunction with the spraying of houses. Data are also included on the number of breeding places treated in the campaign and the quantity of Paris green used in 1939, 1940 and 1941. The totals were 88,267,714 and 261,294 kg., respectively.

GABALDON (A.). **Segundo informe de la Comisión Panamericana de Malaria.** [Second Report of the Pan-american Malaria Commission.]—*Bol. Ofic. sanit. pan-amer.* **23** no. 6 pp. 491–505. Washington, D.C., 1944.

In addition to information on the organisation, nature and extent of work on malaria control carried out in Mexico and most of the countries of Central and South America between 1941 and 1943, and plans for anti-malaria work in the future, this report includes notes on progress that has been made in Anopheline taxonomy and the importance of various species of *Anopheles* as vectors in some of these countries, followed by lists of the Anophelines of America showing the countries in which they occur.

SHAPIRO (J. M.), SALITERNIK (Z.) & BELFERMAN (S.). **Malaria Survey of the Dead Sea Area during 1942, including the Description of a Mosquito Flight Test and its Results.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 2 pp. 95–116, 1 pl., 1 map, 1 graph, 8 refs. London, 1944.

A survey was undertaken in 1942 to determine the source of Anopheline mosquitos at the residential quarters of the Palestine Potash Works at Kallia, at the northern end of the Dead Sea, where cases of malaria had occurred each year since the establishment of the Works. The topography and meteorological conditions are described. The district is divided into three zones, the Kallia neighbourhood, to which most attention is given, and two areas to the north and east of it. *Anopheles multicolor*, Camb., was found breeding near Kallia in a watercourse and in outcrops of brackish water containing 2·5 per cent. salt (sodium chloride), this species and *A. sergenti*, Theo., bred in puddles

along the seashore by the Feshka swamp, some 3½–5½ miles to the south, where the salt content was 0·25–0·65 per cent., and both species and *A. superpictus*, Grassi (*A. sergenti* predominating) bred in the swamp in puddles caused by outcrops of springs and ground water obstructed in their flow to the sea by layers of coarse sand and gravel. The puddles on the shore disappear in autumn and winter, and breeding is then confined to the outcrops.

In the early spring, larvae of *A. multicolor* and *Culex* were found under a layer of gravel 4–6 ins. deep on the seashore between Kallia and Feshka in places where the level of the water rose above the ground surface during the night to form puddles, which disappeared after sunrise. The salt content of these puddles was 2·5 per cent. A few open pools, previously overlooked, and the sub-surface breeding places having been dealt with by oiling and by covering with earth, the numbers of *Culex* and *A. multicolor* in the Kallia area fell noticeably. The numbers of both males and females of *A. sergenti*, however, continued to rise. Two minor Anopheline breeding places in pools and a rather extensive one in a watercourse were found in the area to the north of Kallia, but control measures eliminated them from June onwards. At this time, the mosquito numbers became negligible everywhere, breeding in Feshka also became less intense and work was suspended. The studies were resumed in September, when breeding in the areas north and east of Kallia had been controlled and mosquitos were absent from houses in them. Breeding near the shore at Kallia had also ceased, but *A. sergenti* was present in houses and shelters in various sections in October, November and December and was breeding in the outcrops at Feshka. In both cases, *A. superpictus* and *A. multicolor* were occasionally seen. These findings suggested that Feshka was the source of the adults of *A. sergenti* at Kallia, and further observations tended to confirm this. Males of *A. sergenti* formed about three-quarters of the total taken in the caves in the hills at the western border of Feshka, about half at Kallia Hotel and in the Jewish quarter, but less than 5 per cent. in the Arab quarter, possibly because they remain in the first available shelter, while the females fly to the places most suitable for feeding, such as the unprotected dwellings of the Arabs. Breeding evidently continued at Feshka during the winter, since immature stages were seen and also females with fresh and partly digested blood, developed ovaries, eggs in various stages of development and no accumulation of fat.

In November 1942, adults of *A. sergenti* were found near bushes in the open field between Kallia and Feshka just before and shortly after dark. This and catches made in 1935 suggested that they rest in the open on their way to dwellings in search of blood, and that they might have been hiding in or very near the bushes during the day. No definite influence of wind direction on the numbers taken was noticed, but wind had a deterrent effect on feeding activity.

To make a mosquito flight test, large numbers of adults were collected, marked with gold dust and released in Feshka and catches made later in Kallia were examined for marked mosquitos. Various methods of obtaining the mosquitos were tried. Eventually, they were collected in the swamp one night in November by 14 men who sat from 6 p.m. till 8 a.m. with thighs or legs and arms bared and caught the mosquitos that settled on them. The mosquitos were found to come in waves lasting 30–45 minutes at intervals of about 30 minutes. The 2,600 taken in this way, nearly all *A. sergenti*, were supplemented by a similar number caught in tents, houses and caves on the previous days. The mosquitos were released shortly before sunset at a high place in the middle of the swamp nearly 3½ miles from Kallia Hotel. Other mosquitos were dusted in the caves, which were found to be important resting places. In all, nearly 10,000 mosquitos were marked. Observations after dusting showed that the mosquitos in the caves do not remain inactive during November but use the caves as resting places. Collections of mosquitos were made at Kallia for a month after the release of the marked individuals. One was recovered on 7th November

about 24 hours after release, near a bush just over 2½ miles from the point of liberation and nearly 1½ miles from the Kallia Hotel. A very heavy storm on the following night and day probably killed many mosquitos, and the dusting may have rendered others less able to travel long distances.

The mosquitos taken at Kallia were exceptionally large and strongly pigmented. Some 25 females of *A. sergenti* were found to be carrying pollen of *Anabasis articulata*, which they could not have acquired at a distance of less than ½–1 mile from the point of capture. This strengthens the supposition that at least in the Dead Sea area, *A. sergenti* has become adapted to travelling long distances and to resting during the day and night in caves or on bushes in the open. It is suggested that it may prove possible to use pollen for marking insects. Mites that were found on 20–25 per cent. of the mosquitos of both sexes taken in the caves and on 3–5 per cent. of mosquitos (all *A. sergenti*) taken in the field between Feshka and Kallia or in the houses in the Kallia area in November and December 1942, proved to be Hydrachnids. A search for possible breeding places showed that the mites must have come from Feshka, none being found in water nearer Kallia, all of which had too high a salt content. The finding of a large proportion of males at Kallia and of mites on some of them indicated that they fly as far as the females.

Very few mosquitos were found in Kallia after December, but there were large numbers in the caves near Feshka in January and February. It is suggested that their failure to fly to Kallia at this season may be due to unfavourable weather and to the presence of camels and cattle at Feshka at that time. It is pointed out in a final section that cases of malaria in Kallia usually occur in October-December, when the Anopheline population is at its maximum, and since *A. sergenti* thus constitutes 94–96 per cent. of the Anophelines present, it is considered to be the principal vector.

VAN ROOYEN (C. E.), BOWIE (J. H.) & KRIKORIAN (K. S.). **Typhus Research in Egypt, Palestine, Iraq and Iran.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 2 pp. 133–149, 18 refs. London, 1944.

The following is based largely on the authors' summary of work on typhus in the Middle East carried out between December 1941 and March 1944. Sera from 273 typical, severe cases of typhus fever occurring in Egypt, Palestine, Syria, Iraq and Persia were examined for evidence of agglutinins for Proteus OX19, *Rickettsia prowazeki* and *R. p. mooseri*, and the specificity of the reaction was confirmed by 292 control tests. It was shown by these tests and by isolation in laboratory animals of strains from human cases and lice [*Pediculus humanus*, L.] from patients that epidemic typhus (caused by *R. prowazeki*) recurs annually from January to May in Egypt, Iraq and Persia. It is replaced by murine typhus (caused by *R. p. mooseri*) with the approach of hot weather. However, in September and October when the typhus rate was lowest, cases of epidemic typhus still occurred. Murine rickettsiae were never isolated from lice. In Palestine and Syria, where the incidence of typhus was greatest from August to October and mortality was negligible, the murine type was shown to be responsible. It is suggested that the high incidence of murine typhus in man in the Suez Canal zone, demonstrated by the rickettsial agglutination reaction, is attributable to the presence of enzootic typhus among the rat population and that as each case is accidentally contracted as a result of a bite from a flea, it is possible that the occurrence of numerous cases in late summer may be correlated with the bionomics of *Xenopsylla cheopis*, Roths. The rickettsial agglutination reaction is shown to provide a convenient means of surveying the typhus carrier rate among wild rats in any locality. The authors consider that types of typhus should be classified according to the vector rather than as epidemic and endemic and that the introduction of rickettsial agglutination should make this possible.

MATTINGLY (P. F.). **New Keys to the West African Anophelini.**—*Ann. trop. Med. Parasit.* **38** no. 3–4 pp. 189–200, 2 figs., 17 refs. Liverpool, 1944.

Keys (adapted with considerable modifications from those of Russell, Rozeboom & Stone [*R.A.E.*, B **32** 102]) are given to the larvae and adults (the latter based mainly on the females) of the Anophelines that have been recorded from West Africa. Five species of *Anopheles* have been added to the known fauna of that region since the publication of Leeson's keys in 1939 [**27** 191], and three of these, *A. implexus*, Theo., *A. leesoni*, Evans, and *A. rivulorum*, Leeson, are here recorded from West Africa for the first time, the first having been taken in the Gold Coast and the other two in Nigeria. *A. flavicosta*, Edw., and *A. wellcomei*, Theo., of which the larval characters were not known at the time of Leeson's work, are included in both keys. Three forms that Leeson omitted, probably on account of their rarity, are also included, and new records of them are given. The keys include characters for separating the typical *Anopheles coustani*, Lav., *A. obscurus*, Grünb., and *A. rufipes*, Gough, from their varieties and *A. gambiae*, Giles, from *A. melas*, Theo., which is considered a variety of it [*cf.* **33** 32]. Notes are appended on some of the species, giving local records and morphological data.

GORDON (R. M.) & UNSWORTH (K.). **The prophylactic Effect of Soaps impregnated respectively with Tetraethylthiuram Monosulphide and with Benzyl Benzoate when used once daily to wash Rats exposed to Infection with Scabies due to** *Notoëdres*.—*Ann. trop. Med. Parasit.* **38** no. 3–4 pp. 207–212, 4 refs. Liverpool, 1944.

The following is substantially the authors' summary. Experiments are described in which 10 per cent. tetmosol soap, applied once daily in the form of a lather containing about 1·8 per cent. tetraethylthiuram monosulphide and washed off with six changes of warm water, completely protected four rats constantly exposed to heavy infestations of *Notoëdres* over a period of 16–17 days [*cf.* *R.A.E.*, B **32** 146–147], whereas 10 per cent. benzyl benzoate soap, prepared and used in the same way, afforded no protection ; 2 and 1 per cent. tetmosol soap, applied once daily as a lather containing, respectively, 0·4 and 0·2 per cent. tetraethylthiuram monosulphide, protected a considerable proportion, but not all, of 12 rats exposed to moderate infestation by *Notoëdres* over a period of 14 days ; and 5 per cent. tetmosol soap, applied once daily as a lather containing 0·9 per cent. tetraethylthiuram monosulphide, completely protected 12 rats against a moderate infestation of *Notoëdres* for 14 days, and a single rat that was exposed to an intense infestation for 16 days. It is concluded that 5 per cent. is the lowest concentration of tetraethylthiuram monosulphide likely to protect man completely from scabies (*Sarcoptes scabiei*, Deg.) when incorporated in soap to be used once daily [*cf.* **33** 89].

HELLIER (F. F.). **Scabies and D.D.T.**—*Brit. med. J.* no. 4416 p. 255, 1 ref. London, 1945.

Investigation in two areas showed that 52 of 100 soldiers who were infested with scabies [*Sarcoptes scabiei*, Deg.] and 52·2 per cent. of 211 who were not, had been wearing shirts impregnated with DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] or had been using DDT powder regularly within the preceding two months. It thus appears that DDT has no action in preventing infestation by the mite.

CULPEPPER (G. H.). **The Rearing and Maintenance of a Laboratory Colony of the Body Louse.**—*Amer. J. trop. Med.* **24** no. 5 pp. 327–329, 3 figs., 1 ref. Baltimore, Md., 1944.

In experiments made in Florida between May 1942 and October 1943 on the control of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.), some 1,325,000 lice and eggs were used. The lice were reared from a small number collected from healthy persons and fed on volunteers who had shown no evidence of disease. They were kept at 86–90°F. and a relative humidity that was not excessively high on pieces (patches) of loosely woven dark-coloured woollen cloth about $1\frac{1}{2}$ ins. square resting on $\frac{1}{2}$-inch-mesh wire netting in crystallising dishes 8–10 ins. in diameter. A relative humidity of 85–90 per cent. affected survival and reproduction adversely. About 100 adult lice could be kept on each patch of cloth. To obtain batches of fairly uniform age, the adults were removed from the patches bearing eggs every 48 hours. Nymphs were left on the patches on which they had hatched, but the newly moulted adults were transferred to fresh pieces of cloth. Patches bearing nymphs were cleaned by spreading them in a shallow pan, drying them with an ordinary electric lamp and rubbing them lightly together in the hand, after which the débris was shaken off while the lice held on to the cloth. All glass containers were cleaned regularly.

The lice were fed twice daily by placing the patches bearing them in lines across the back of a volunteer lying in a prone position, leaving spaces between series of a few lines. As many as 30–40 thousand lice could be fed at a time on one man. A man was not ordinarily subjected to feeding more than once per week, but in four instances, individuals voluntarily fed some 40,000 lice each on two successive days without apparent ill effect. Some men showed no visible reaction and experienced only slight, transient itching, while others developed dermatitis that persisted for 2–3 days. In the case of a few men, it persisted 7–10 days, and these were not used again. Many have been feeding lice for 6–18 months, without adverse effect. Adults began to feed at once, but nymphs were slower, and to hasten them, a lamp was held 12 ins. above them for a short time. Repelled by the light and heat, they retired beneath the patches and began to feed. The entire process, including placing and removing the patches and redressing, was completed in 30–45 minutes. To transfer lice to clean patches, a layer of these patches was placed in a shallow dish fitted inside a large pan of cold water, and covered with a piece of $\frac{1}{8}$-inch-mesh wire gauze over which the patches bearing the lice were placed. Electric lamps were arranged about 12 ins. above the lice. These were repelled by the light and heat and moved to the lower layer of cloth, which was kept cool by the water. If the patches bear eggs, a temperature above 105°F. in the shallow dish should be avoided.

[ALPATOV (V. V.), NASTYUKOVA (O. K.) & KHARTULARI (E. M.).] **Алпатов (В. В.), Настюкова (О. К.) и Хартулари (Е. М.). Eggs of the Body and Head Form of *Pediculus humanus* L. in Relation to the Breeding Conditions.** [*In Russian.*]—*Zool. Zh.* **24** no. 1 pp. 42–47, 2 figs., 9 refs. Moscow, 1945. (With a Summary in English.)

Authorities are not in agreement as to whether the body and head forms of *Pediculus humanus*, L. (*humanus* and *capitis*, Deg.) are specifically or even subspecifically distinct. In investigations in Moscow in 1942, statistical analysis of measurements of large numbers of eggs laid on human hair at 30°C. [86°F.] by females of the two forms taken from natural infestations showed that there were significant differences between the two. To determine whether these

differences would persist when head lice were reared under conditions proper to body lice, six generations of both forms were reared by keeping the lice in small celluloid pill-boxes with the lid and bottom of bolting silk enclosed in perforated wooden boxes that were worn on the chest beneath the underclothes and feeding them three times daily on the hand. Simultaneously, both forms were reared off the host at a constant temperature of 30°C., ten generations of body lice and six of head lice being obtained. Measurement of the eggs of the body lice laid under both these conditions showed that there were no statistical differences between them and the eggs of lice taken under natural conditions on underclothes. In the case of the head lice, however, the differences characterising the eggs gradually disappeared, whether the lice were worn on the chest or kept at 30°C., and eggs of the fifth and sixth generations could not be distinguished from those of body lice.

The authors conclude that the head louse and the body louse represent variations of a single species (*P. humanus*), and, although no certain data were obtained as to the factors inducing such variation, they suggest that temperature is mainly responsible. They also suggest that this phenomenon may be of importance in the epidemiology of typhus, since if groups of people infested with head lice but not body lice do not change their underwear for long periods, the lice that drop on to their clothes may breed there for several generations and so transform into body lice.

Bueno (R. C.). **Os ectoparasitos das aves *Argas persicus* e *Liponyssus bursa*.** [The Ectoparasites of Birds, *A. persicus* and *L. bursa*.]—*Biológico* **10** no. 9 pp. 293–297, 1 pl. São Paulo, 1944.

To assist poultry-keepers in Brazil to recognise infestation of fowls by *Argas persicus*, Oken, and *Liponyssus bursa*, Berl., the life-histories of these parasites and their various stages are described. Methods of preventing infestation are briefly reviewed, and treatment with sodium fluoride is recommended for the control of *L. bursa*. It should be well rubbed into the affected parts or used as a dip at a concentration of 0·5 per cent.

Reading (B.) & Klint (H. A.). **Clinical Observations on Spotted Fever in the Gulf Coast Area of Texas.**—*Texas Rep. Biol. Med.* **1** no. 2 pp. 97–104, 4 figs., 4 refs. Galveston, Tex., 1943. [Recd. 1945.]

Anigstein (L.) & Bader (M. N.). **Investigations on Rickettsial Diseases in Texas. Part 1. Epidemiological Role of Ticks common to the Gulf Coast in Relation to local Spotted Fever.**—*T.c.* pp. 105–116, 3 figs., 8 refs. **Part 2. Experimental and epidemiological Studies on an Outbreak of Spotted Fever in the Gulf Coast.**—*T.c.* pp. 117–140, 11 figs., 15 refs.

Accounts are given in the first paper of four fatal cases of disease that occurred in one locality in the central lowland prairie of the Gulf Coast area of Texas, one in 1937, one in 1939, and two in 1942. The first was diagnosed at the time as typhus, but the last two were proved to be spotted fever [*R.A.E.*, B **31** 43], and it is thought probable that the others, as well as some of the increasingly large number of cases of illness in Texas that have been reported as endemic typhus, may in reality have been spotted fever.

This possibility is also mentioned in the second part of the second paper, which deals at some length with the outbreak of spotted fever that occurred in 1942. This consisted of the two proved fatal cases already referred to and two non-fatal cases that were in all probability spotted fever also. A brief account of this outbreak has already been noticed [*loc. cit.*]. The region has

a semi-tropical climate, fertile soil, luxuriant flora and a rich tick fauna. A list of the species of ticks that occur in the Gulf Coast region is given. The children who died acquired the disease soon after they came to live in a trailer camp at the height of the tick season. The others had been in the camp for four months and were frequently bitten by ticks. The milder course of their infection might be explained by supposing that they had acquired a partial immunity through repeated bites from ticks of low infectiveness. The most usual domestic hosts of *Amblyomma americanum*, L., the only tick found in the locality, are dogs and the next cattle. Man is more frequently attacked by it than by any other tick. It is widely distributed over the eastern and southern States and very abundant on ranches in Texas. It may, therefore, be responsible both for maintaining the spotted-fever rickettsia in nature and for transmitting it to man. Injection into guineapigs of suspensions of seven pooled adults of *A. americanum* from dogs and a cow at the trailer camp resulted in death in one case and fever in the other and conferred partial immunity from spotted fever to the guineapigs through which the strain was passed. The strains of the infective agent that were isolated from the two fatal cases differed in virulence to guineapigs. Only minor differences were noted between the Texas strains and a strain from *Dermacentor andersoni*, Stiles, from Idaho, with regard to incubation, type and length of fever, but there was a difference in the scrotal reaction. The strains from the fatal cases were immunologically identical and showed immunological reciprocity with Rocky Mountain spotted fever. Exanthematic typhus gave no protection against the Texas strains. Tick vaccine [**15** 217] and egg-yolk-sac vaccine prepared against Rocky Mountain spotted fever both gave complete protection against Texas spotted fever.

It is concluded that the American diseases of the spotted fever group are immunologically identical, although the Rocky Mountain disease is carried by *D. andersoni*, while those of Texas, Brazil [*cf.* **31** 78] and Colombia [**32** 39, etc.] are carried by ticks of the genus *Amblyomma* [*cf.* also **32** 45.] It is suggested that the geographical designation should be replaced by epidemiological criteria.

In experiments recorded in the first part of the second paper, positive Weil-Felix reactions usually against all three strains of Proteus (OX19, OXK and OX2) were obtained with 19 out of 21 dogs from the Gulf Coast area of Texas that were heavily infested with *Rhipicephalus sanguineus*, Latr., and only 10 out of 77 other dogs from the same region. This suggested that *R. sanguineus* might be a local vector of rickettsiae [*cf. R.A.E.*, B **21** 239]. One of seven cows free from ticks, 18 of 78 cows, mostly infested with *Amblyomma americanum* and *A. maculatum*, Koch, and 22 of 124 pigs all gave positive reactions, the tick-free cow against OX19 only. Injection into guineapigs of suspensions of some 2,500 adults of *R. sanguineus* of both sexes, collected in 1941 and 1942 from apparently healthy dogs from various localities where the serological survey was made, and of 2,000 larvae and nymphs reared from eggs, caused fever in most cases after an incubation period of 2–11 days. The fever was occasionally accompanied by a scrotal reaction. One infection was produced in a rabbit, which simultaneously developed a significant rise in Proteus OX19 agglutinins. Suspensions of examples of *A. americanum* collected from cattle in south-eastern Texas proved in most cases to be highly virulent when injected into guineapigs. They often produced high fever of short duration after an incubation period of 2–3 days, frequently followed by death. The virulence of *A. maculatum* was lower, but there was a definite incubation period of 4–6 days followed by fever for about a week and no scrotal reaction. The guineapigs that survived after being inoculated with *Rhipicephalus* and *Amblyomma* were not immune from local strains of murine typhus. The infections produced in

the experiments with *A. americanum* and *R. sanguineus* were suggestive of a spotted fever, but there was less evidence of this in the case of *A. maculatum* [*cf.* **28** 28].

ANIGSTEIN (L.) & BADER (M. N.). **Preliminary Report on Investigations of Bullis Fever.**—*Texas Rep. Biol. Med.* **1** no. 3 p. 298, 2 refs. Galveston, Tex., 1943. [Recd. 1945.] **Investigations on Rickettsial Diseases in Texas. Part 4. Experimental Study of Bullis Fever.**—*T.c.* no. 4 pp. 389–409, 9 figs. (1 col.), 9 refs.

It is recorded in the first paper that in the course of work begun in July 1943, during which 500 adults of *Amblyomma americanum*, L., from Camp Bullis, Texas, were divided into five batches of 100 and suspensions of each batch were injected into guineapigs and white mice, a strain of an infectious agent was established in guineapigs and carried in passages. The symptoms and pathological lesions produced in guineapigs and mice corresponded, generally, to those induced by the disease of man recently described as Bullis fever [*R.A.E.*, B **32** 132]. An intracytoplasmic rickettsia invading lymphocytes and monocytes and similar to that observed in the strain of human origin [*cf. loc. cit.*] was established in various tissues of guineapigs and mice infected with the strain from the ticks. Also, guineapigs convalescent from the infection induced by ticks proved immune from the human strain. No immunity from spotted fever or American Q fever [*Rickettsia diaporica*] was found. It seems highly probable, therefore, that the rickettsia recovered from *A. americanum* is the agent of Bullis fever, and that the latter is a new rickettsial disease transmitted to man in nature by this tick.

The second paper deals with the same studies in some detail. It is stated that although the disease in man is sometimes rather severe and debilitating, it is practically never fatal, but there are indications that it is increasing in severity. There is some clinical resemblance between Bullis fever and tsutsugamushi disease and also a morphological resemblance between their rickettsiae. *A. americanum* constitutes about 98 per cent. of the local tick population.

PAPERS NOTICED BY TITLE ONLY.

EYLES (D. E.). **A critical Review of the Literature relating to the Flight and Dispersion Habits of Anopheline Mosquitoes.**—*Publ. Hlth Bull.* no. 287, 39 pp., 9½ pp. refs. Washington, D.C., 1944.

WOMERSLEY (H.). **Notes on and Additions to the Trombiculinae and Leeuwenhoekiinae (Acarina) of Australia and New Guinea.**—*Trans. roy. Soc. S. Aust.* **68** pt. 1 pp. 82–112, 14 figs. Adelaide, 1944. [*Cf. R.A.E.*, B **32** 161.]

HALL (M. C.), DIKMANS (G.) & WRIGHT (W. H.). **Parasites and Parasitic Diseases of Sheep** [in the United States].—*Fmrs' Bull. U.S. Dep. Agric.* no. 1330 (revd.), 49 pp., 34 figs., 4 refs. Washington, D.C., 1944. [*Cf. R.A.E.*, B **9** 110; **20** 180.]

GUÉNAUX (J. [*i.e.* G.]). **Entomología y parasitología agrícolas. Versión española de la quinta edición francesa revisada y aumentada por José del Cañizo.** [Agricultural Entomology and Parasitology. Spanish Version of the fifth French Edition revised and augmented by José del Cañizo.] —xx + 664 pp., 427 figs., refs. Barcelona, Salvat Edit. S.A., 1943. Price *Ptas.* 58. [Recd. 1945.] [*Cf. R.A.E.*, A **6** 134.]

[Pavlovskiĭ (E. N.) & Skruinnik (A. N.).] **Павловский (Е. Н.) и Скрынник (А. Н.). On the Period during which Females of *Ornithodorus papillipes* are able to transmit the Tick Relapsing Fever.** [*In Russian.*]—*Zool. Zh.* **24** no. 3 pp. 161–164. Moscow, 1945. (With a Summary in English.)

Of a batch of 24 nymphs and adults of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) taken in October 1931 in a cave near Stalinabad (western Tadzhikistan) and brought to Leningrad, 14 were alive in February 1933, ten in May 1934, six in April 1935, three (all females) in October 1940, and two in January 1941. During these years the ticks were allowed to feed at intervals on laboratory animals, and they transmitted spirochaetes of relapsing fever, with which they were naturally infected, to guineapigs and *Dyromys nitedula*. In September 1941, the two surviving females were sent in a thermos flask to Samarkand, where they arrived in October 1942. They had not fed for about two years, and one of them was dead in the following month. The other was taken back to Leningrad in June 1944, together with an adult male that had been found in western Kirghizia in 1935, and both were allowed to feed on a guineapig in October 1944. The latter subsequently showed spirochaetes in its blood, and as the male had failed to infect laboratory animals on any of the occasions on which it had fed alone, it is concluded that they were transmitted by the female.

Previous investigations by the authors have shown that *O. tholozani* can live for up to 25 years and can resist starvation for up to 7½ years. Its long life, the fact that spirochaetes persist in it from generation to generation, its wide range of hosts, other than man and domestic animals, and its tendency to move about little [*cf. R.A.E.*, B **31** 162] ensure the preservation in nature of foci of relapsing fever.

Soldatova (A. P.). **A Contribution to the Study of the Biology of Oribatei Mites, intermediate Hosts of Cestodes of the Family Anoplocephalidae.**—*C. R. Acad. Sci. URSS* (N.S.) **46** no. 8 pp. 343–344, 7 refs. Moscow, 1945.

The duration of adult life of the Oribatid mites that are intermediate hosts of various Anoplocephaline Cestodes [*cf. R.A.E.*, B **30** 141; **31** 85; **33** 149] is a question of particular importance, as the mites become infested with eggs of the tapeworms after they reach the adult stage. Laboratory observations were therefore carried out in Russia in which freshly moulted adults of *Scheloribates laevigatus*, Koch, *S. latipes*, Koch, and *Galumna obvius*, Berl., were kept in boxes containing decayed leaves, moss and rotten wood and were examined and transferred to fresh boxes at intervals of 10–15 days and more frequently after the first dead mites were found. The shortest and longest periods of life were 15 months 6 days and 15 months 17 days for *S. laevigatus*, 14 months 27 days and 15 months 27 days for *S. latipes*, and 13 months and 15 months 5 days for *G. obvius*. Since the various Cestodes reach the infective stage in the mites within periods of up to 5 months 20 days, the mites may remain infective for 9–10 months.

When the mites were bred individually from egg to adult at 18–23°C. [64·4–73·4°F.], the immature stages lasted 97 days for *S. laevigatus*, 84 for *S. latipes*, and 109 for *G. obvius*.

Milne (A.). **The Ecology of the Sheep Tick, *Ixodes ricinus* L. The seasonal Activity in Britain with particular Reference to northern England.**—*Parasitology* **36** no. 3–4 pp. 142–152, 3 figs., 15 refs. London, 1945. **Host Availability and seasonal Activity.**—*T.c.* pp. 153–157, 1 fig., 6 refs.

A survey of the seasonal incidence of *Ixodes ricinus*, L., in northern England in 1940–43, described in the first paper, showed that females are usually plentiful on sheep in spring and again but to a smaller extent in autumn, the

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dates of these seasons of prevalence being somewhat variable. Practically no females are found in winter and very few for a period of varying length in summer [*cf. R.A.E.*, B **27** 190]. On a farm in north-eastern Northumberland, however, and also in an area in southern Scotland, there was only one annual peak in infestation, in April–May, and on a moor in north-eastern Scotland there was a single peak in July [**27** 191]. The theory that activity (host seeking and infestation) by the females is restricted to periods with an average weekly maximum shade temperature of 45–60°F. [**27** 191] is refuted by the fact that at the Northumberland farm where the spring female activity took place when the temperature was within this range, there was no autumn recrudescence when temperatures passed through it again, and also by the occurrence of about half the annual female activity on a farm in south-western Cumberland, and practically all on the moor in north-eastern Scotland, at temperatures of 60–70°F. and 60–65°F., respectively. The curve for weekly average solar radiation followed that for the weekly average of the daily maximum shade temperature and in one instance reached its peak during the autumn period of activity. There was no obvious correlation between seasonal activity and evaporation rate, which declined more or less uniformly from spring to autumn. Humidity by itself was not directly correlated with the rhythm of tick activity, but it is tentatively concluded that the duration of the period of adequate humidity during daylight, when ticks seeking hosts are on the grass tips, in conjunction with temperature, may partly decide the extent of activity in summer.

The activity of larvae, nymphs and males was studied by blanket-dragging [**32** 105]. It was confirmed that in spring, where spring activity obtains, males and females appear in small numbers a few weeks before nymphs [*cf.* **20** 274], but the bulk of male, female and nymphal activity in spring is concurrent, and that the larval activity begins later and reaches its peak about a month later. Various theories on seasonal activity are discussed.

In the second paper, an account is given of three experiments in which sheep were withheld from a grazing area for lengths of time up to three weeks after the normal spring peak period of activity of females of *I. ricinus*. The activity of the females was not appreciably prolonged into the normal summer off-season by the withholding of hosts, and more than half the female ticks actually available during the spring season were unfed when activity ceased. Hence, that aspect of the " two-brood " theory (formulated by E. G. Wheler in 1899) which claims that activity ends in spring, because all the available ticks are fed, is untenable, and the theory does not provide the complete explanation of bimodal annual activity. At least some of the autumn ticks, however, should be the offspring of those that fed in spring, so the two-brood theory may provide a partial explanation. An increase in the density of sheep over the normal for a grazing lowered the average infestation per sheep for that season at least. Delay in stocking a grazing ground with sheep did result in a slightly larger population of active females than the normal at the time. The excess was fairly quickly absorbed after the reintroduction of the sheep. The findings suggested that a varying proportion of the tick population becomes active each week throughout the tick season, increasing up to the peak and decreasing thereafter. The average duration of individual activity in a natural population of females of *I. ricinus* is probably not more than a month, perhaps less. It is inferred that stock can have the run of infested land in the normal off-seasons of activity without danger of infestation, even if there has been no grazing on the land in seasons of activity. Tick populations could be considerably reduced by grazing on infested land only during the off-seasons, since farm stock, especially sheep, are the principal hosts and a full blood-meal is required to enable the female tick to oviposit. In Cumberland, lambs are often not put on to highly infested fell land until spring tick activity has nearly died down, so that they are well grown, and consequently less susceptible to tick troubles, before they come into contact with ticks during the autumn infestation.

CRAGG (J. B.) & RAMAGE (G. R.). **Chemotropic Studies on the Blow-flies *Lucilia sericata* (Mg.) and *Lucilia caesar* (L.).**—*Parasitology* **36** no. 3–4 pp. 168–175, 17 refs. London, 1945.

Oviposition by *Lucilia sericata*, Mg., on a moist, clipped fleece was induced by the addition of ammonium carbonate or indole. This indicated that the differentiation of the attractant into a *P* factor (product of putrefaction) and an *S* factor produced solely by the living sheep [*cf. R.A.E.*, B **25** 52–53] is not wholly necessary. The *S* factor could evidently arise, at least in part, from the fleece alone, and it seemed likely that a breakdown of fleece keratin with the possible production of sulphur-containing compounds from the cystine might be involved. The problem of analysing the agents responsible for attracting blowflies to sheep was therefore re-examined. The procedure used in making the chemical examinations is briefly described, and the results obtained with various substances are shown in a table, which also includes Hobson's rating of their attractiveness to *L. sericata* [*cf.* **23** 227]. The ammonia content of each substance and its sulphydryl value expressed as hydrogen sulphide are given, and also the indole and skatole content, if determined. The materials that are attractive are shown to be characterised by a substantially higher contents of ammonia, sulphydryl compounds and, when present, indole-skatole than others. The more fluid condition of scouring dung made it more attractive than ordinary dung. The highly attractive excreta of the larvae contained hydrogen sulphide, but no indole or skatole was detected in it. The ammonia and sulphydryl contents of various natural attractants are markedly increased by incubation. The field results obtained by Hobson in the attempted chemical separation of larval excreta [**25** 53] can be readily interpreted if the active agent is a disulphide or sulphydryl compound in conjunction with ammonium carbonate.

The minimum effective concentrations of some substances as attractants were tested in North Wales in August and September 1943 by absorbing a known amount on a pad of cotton-wool and fastening the pad to the fleece of a sheep, which was let loose for about two hours and then rounded up for any egg batches to be counted. It was shown that 0·002 per cent. ethyl mercaptan in conjunction with 0·1 per cent. ammonium carbonate would induce oviposition by *L. sericata*, but neither component alone was active at these concentrations. The mercaptan concentration could be reduced to 0·001 per cent. if 0·0001 per cent. hydrogen sulphide was present. Aqueous solutions of hydrogen sulphide and 0·01 per cent. ethyl mercaptan alone were not attractive. These results were obtained under adverse weather conditions. They support the hypothesis that attraction is the result of the breakdown of cystine, with the production of sulphur compounds, coupled with the presence of ammonium carbonate (or of some putrefactive material).

At the same time, experiments with traps were carried out with sheep wool and attractants. The trap was a cylinder of mosquito netting 1 ft. 9 ins. high and 11 ins. in diameter, with a cone of the same material inside, the apex forming the entrance for the flies. It was supported on a wire framework over a glass vessel containing the attractant solution and surrounded by ½ lb. sheep wool. Exposure was usually for 2–3 hours. Nearly all the flies attracted to the baits were females of *L. caesar*, L. (including *L. illustris*, Mg., and *L. ampullacea*, Villen., the females of these three species being indistinguishable). Catches in traps baited with guineapig carcasses showed that the population of *L. sericata* at the time was small. Various combinations of ammonium carbonate, hydrogen sulphide and indole, in conjunction with sheep wool, were attractive. Where hydrogen sulphide was included, attraction was greater when it was kept in a separate container than when it was mixed with the other constituents.

The factors produced by the living sheep, whether by bacterial decomposition alone or supplemented by irradiation of the fleece, are more effective in attracting females and inducing oviposition than any combination so far used of clipped fleece and chemicals. It is thought probable that indole and skatole do not play a principal part in naturally induced strike, and that their efficiency as attractants may be related to their power as fixatives.

JASWANT SINGH & JACOB (V. P.). **Malaria Investigations in North Kanara.**—*J. Malar. Inst. India* **5** no. 3 pp. 267–303, 2 maps, 2 charts, 14 refs. Calcutta, 1944.

An account is given of a malaria survey of North Kanara, the southernmost district of Bombay Presidency, carried out between May 1942 and May 1943. The district is described, with notes on its climate and population. Localities in the relatively non-malarious coastal area were studied for comparison with the highly malarious sections in the interior. Dispensary records for 1938-42 showed a higher incidence of malaria in the colder months (November to March) than at other times. Spleen examinations of children 2-10 years old showed that malaria is endemic in the foothill region and hyperendemic in the ghat section, but the spleen rates were usually below 5 per cent. near the coast. The parasite rates among children were 21·6 per cent. in June and July 1942 and 17·8 per cent. in February 1943, but this fall is thought to be attributable to the absence from the second examination of many children who were ill with fever. The most prevalent parasite was *Plasmodium malariae*, which formed about 60 per cent. of the total. *P. falciparum* and *P. vivax* occurred in approximately equal proportions. A special study of the parasite rate in infants indicated that transmission takes place throughout the year. In an investigation made in one town in June and October 1942 and February 1943, infections in June, when the rate was highest, were mostly due to *P. falciparum* and *P. vivax*, while infections with *P. malariae* predominated in October and February.

During the survey, 20,781 adult Anophelines were caught in stables and 9,835 in human dwellings. Of these 28,537 were females. The most numerous species was *Anopheles jeyporiensis*, James. *A. pallidus*, Theo., *A. subpictus*, Grassi, and *A. vagus*, Dön., came next in order of abundance, followed by *A. culicifacies*, Giles, and *A. fluviatilis*, James. Anopheline larvae were found in 2,133 out of 3,675 collections made in typical breeding places. Brief notes are given on the bionomics of the 23 species of *Anopheles* taken either as larvae or adults. *A. fluviatilis* was the only one found infected with malaria parasites, and had gut, gland and total infection rates of 6·2, 7·1 and 11 per cent. The total rate is lower than those recorded for this species in the Wynaad [*R.A.E.*, B **28** 162] and Nilgiris foothills [**31** 117]. The infection rate was highest in October. There was no indication that any other species was involved in transmission. Qut of 113 mid-guts of *A. fluviatilis* on which the precipitin test was made, 88 gave positive results, 56 for human blood and 32 for blood of cattle.

Neither adults nor larvae of *A. fluviatilis* were found in large numbers. Of the 1,010 adults taken, 972 were from dwellings and 38 from stables. They rested on the lower part of the roof, just below the angle of the roof with the walls, or on the floor. They were most prevalent in October, November, April and May and least so in August. The most favoured breeding places were streams with slow-running water and vegetation along the edges. Larvae were sometimes taken in streams without vegetation, in small pockets containing pebbles. Channels were next in order of preference and then pools along the edges of the river, and some larvae were found occasionally, chiefly during the monsoon months (June–August), in reservoirs, rice-fields, shallow

wells and pits. Collections made before the monsoon yielded most larvae and those made during the monsoon least. Whatever the type of breeding place, it was always near human dwellings [*cf.* **28** 162 ; **32** 149]. *A. fluviatilis* was seldom taken near the coast.

Control measures against *A. fluviatilis* can be restricted to a comparatively small area round a town or village [**32** 150]. Breeding in streams can be prevented by training their course and providing regular edges free from vegetation for half a mile upstream and downstream from the houses to be protected [**32** 153]. Flushing from dams with hand-operated sluice-gates should be carried out where conditions permit, and herbage packing in channels from rice-fields [**28** 162] can be used with advantage. Paris green or *Gambusia* may be employed in wells. As the adults choose human habitations for their daytime resting place, the use of a pyrethrum spray twice a week soon after dawn should prove of special value. Screening and personal protection with mosquito nets are also desirable. In view of the length of the transmission period, the measures must be carried out almost all the year round.

ABRAHAM (A. C.) & SAMUELS (R. D.). **Epidemiology of Malaria in the Nizamsagar Ayacut Area, Nizamabad District, Hyderabad State.**—*J. Malar. Inst. India* **5** no. 3 pp. 305–318, 1 map, 2 graphs, 1 ref. Calcutta, 1944.

An account is given of the malaria conditions observed in 1940–42 and the control measures adopted in 1942 in Nizamabad District, Hyderabad State, where malaria was not an important problem before the introduction of canal irrigation under the Nizamsagar Project, which was completed in 1933. Its incidence has greatly increased since the scheme was put into operation, owing to such defects in the system as inadequate provision for drainage, failure to maintain distributaries and channels, absence of double banking, defective sluice gates, the excavation of borrowpits, and seepage. Its spread was further favoured by the introduction of large numbers of labourers who formed a reservoir of infection. Out of 865 blood films examined, 45·75 per cent. were positive ; 19, 16·4 and 12·7 per cent. contained *Plasmodium malariae*, *P. vivax* and *P. falciparum*, respectively, some of the infections being mixed. Of 1,415 and 5,755 children examined during the malaria season (September–January) in 1941–42 and the off season (May–July) in 1942, 48·8 and 13·9 per cent. had enlarged spleens. There was no positive correlation between the incidence of malaria and the amount of rainfall.

A list is given of the 15 species of *Anopheles* found in the district with notes on their breeding places if immature stages were taken. Varying numbers of the 11 most abundant were dissected, including 1,442 of *A. culicifacies*, Giles, and 177 of *A. fluviatilis*, James, but only one infection was found, in a gut of *A. fluviatilis*. This is considered the chief malaria carrier, but *A. culicifacies* probably plays some part in transmission. The principal breeding places of these species were rivers, distributaries and improperly maintained field channels and sometimes borrowpits, swampy tracts and temporary collections of water. *A. fluviatilis* was least plentiful from April to July and *A. culicifacies* in April and May.

The chief measures adopted in the malaria control scheme inaugurated in 1942 are the killing of mosquitos in villages with sprays consisting of one part pyrethrum extract containing 1 per cent. pyrethrins in seven parts kerosene applied once a week, the weekly use of Paris green (1 per cent. in sifted road dust) and oil on breeding places, and various minor levelling and drainage operations. Mass prophylactic treatment with quinine is carried out in certain villages where the disease is hyperendemic. Results are encouraging.

YACOB (M.) & SATYA SWAROOP. **The Forecasting of epidemic Malaria in the Punjab.**—*J. Malar. Inst. India* **5** no. 3 pp. 319–335, 1 map, 4 refs. Calcutta, 1944.

Widespread epidemics of malaria occur periodically throughout north-western India, especially in the districts of the Punjab lying within the Indo-Gangetic plain. They usually develop during years of very heavy monsoon rainfall accompanied by river flooding after a succession of years with defective rainfall, and are particularly likely to occur if several years have elapsed since the last epidemic. Every year at the end of August or beginning of September, a forecast of the probable prevalence of malaria in the different districts of the province is issued, based on the degree of immunity as indicated by spleen rate in June, the rainfall in July–August, the epidemic potential of individual districts (coefficient of variability of incidence of October fevers worked out for a period of 53 years), and the economic factor (price of staple grain food during the preceding year). The rainfall in July and August serves as an indirect index of humidity and of its important effect in prolonging the life of Anophelines and consequently their ability to transmit malaria; rain evenly distributed over the two months is therefore more favourable for an epidemic than a heavy downpour towards the end of August, which may even wash away and destroy the larvae.

The forecasts issued in 1929 and 1934–42 and the epidemic figure (obtained by dividing the average monthly fever mortality during October December by that during April July of the same year) for each of 29 districts for these years are shown in appendices. The accuracy of the method used is statistically evaluated, and it is shown that epidemics have been predicted with some precision. The making of the forecast by this method involves a personal factor, but as the data on which it is based are numerical, it should be possible to replace the personal factor by the use of statistical methods of regression and trends.

D'ABRERA (V. ST. E.). **The Eggs of the Ceylon Anopheline Mosquitoes.**—*J. Malar. Inst. India* **5** no. 3 pp. 337–359, 1 pl., 1 map, 18 figs., 22 refs. Calcutta, 1944.

The eggs of 16 of the 20 species of *Anopheles* known to occur in Ceylon were examined over a period of 18 months. Full descriptions are given of the eggs of *A. gigas* var. *refutans*, Alcock, and *A. aitkeni*, James, which were hitherto unknown, and also revised descriptions of those of *A. barbirostris*, Wulp, *A. hyrcanus* var. *nigerrimus*, Giles, and *A. karwari*, James, notes on the differences between the published descriptions and examples examined of those of *A. varuna*, Iyen., *A. culicifacies*, Giles, and *A. annularis*, Wulp, and the measurements of those of the remaining eight species, including two forms of *A. jamesi*, Theo. A key is also given to the eggs of 18 Ceylon species.

The eggs were usually obtained from gravid females that were collected in houses or cattle-baited traps and confined singly in glass cylinders covered with netting and standing on a petri dish containing a layer of damp filter paper and a smaller dish of water. Split, moistened raisins were placed on top of the netting as food. The eggs of three species were collected in the breeding places, as wild adults were unobtainable. To preserve the eggs long enough for examination, they were kept in water for at least 20 hours to allow the embryo to develop sufficiently for the larva to occupy the whole of the capsule. They were then transferred to a strong solution of formalin for a few minutes a $2\frac{1}{2}$ per cent. solution of borax formal was run in when the formalin was drawn off, and the tube was labelled and stored. For examining the texture of the exochorion, white, mature eggs were obtained by dissection from gravid females, as they could be more satisfactorily examined under high power than

the highly pigmented laid eggs. They were placed in water and punctured to release the opaque yolk substances. When the egg cases contained only water, 5 per cent. formalin was introduced and the cases were left overnight for hardening. They were then mounted in 5 per cent. formalin. They could be successfully stained with carbol fuchsin. Observations are recorded on the behaviour of one female of each of three species during oviposition.

SIDDONS (L. B.). **The Experimental Transmission of Quartan Malaria by *Anopheles culicifacies* Giles.**—*J. Malar. Inst. India* **5** no. 3 pp. 361-373, 2 graphs, 24 refs. Calcutta, 1944.

Experiments in which gland infection with *Plasmodium malariae* has been obtained in Anophelines are briefly reviewed, and an account is given of studies on the development of this *Plasmodium* in artificially infected females of *Anopheles culicifacies*, Giles, and its transmission by them. The mosquitos used were reared in the laboratory from full-grown larvae and pupae collected in the field, and, apart from their infective meal, were maintained on raisins and water. Thick blood films from the gametocyte carriers were always examined for detection of mixed infections. The percentages of gut and gland infections and the total percentage infection obtained were 4·9, 6·5 and 9·4, respectively. The minimum density of gametocytes with which a positive result was obtained was 295 per cu. mm. The infectivity of the gametocytes, which appears to be a more important factor in the infection of *A. culicifacies* than the susceptibility of the mosquito, was found to be highest during the cold weather, as exemplified by conditions in Calcutta. Quartan malaria is largely a cold-weather illness. The extrinsic incubation period of *P. malariae* in *A. culicifacies* was as low as 14 days at 80°F. and 19–22 days at 70°F. Infection was transmitted to a man by 12 females, four of which were shown immediately after the feed to have moderate gland infections. The intrinsic and clinical incubation periods were 30 and 36 days. Observations on periodicity, rate of segmentation, development of resistance and gametocyte production in the untreated infection are recorded.

If an efficient vector is present, a climate characterised by high atmospheric humidity for long periods is one of the most important factors in the distribution of quartan malaria ; *P. malariae* has recently been found to be the predominant malaria parasite in Ceylon but is scarce in the Punjab, where humidity is not high for any length of time, though *A. culicifacies* is the only proved vector in the former and the chief one in the latter.

SIDDONS (L. B.). **Observations on the Influence of Atmospheric Temperature and Humidity on the Infectivity of *Anopheles culicifacies* Giles.**—*J. Malar. Inst. India* **5** no. 3 pp. 375–388, 27 refs. Calcutta, 1944.

An account is given of unfinished work on the influence of atmospheric temperature and humidity on the development of malaria parasites to the infective stage in *Anopheles culicifacies*, Giles, carried out on females bred from full-grown larvae and pupae collected from rivers and streams in Bengal and the Chota Nagpur Ranges. As the result of experience in the early part of the work, only carriers showing at least one gametocyte of each sex per 100 leucocytes were used in the later stages. The females did not always bite very readily. Most of the work was done in ordinary biological incubators, but some in an air-conditioning cabinet [*cf. R.A.E.*, B **32** 148] and some in an air-conditioned cool room.

The following is based on the author's summary of the results. Lowering of temperature within the range 94–70°F., particularly when combined with an increase in relative humidity, lengthened the life of *A. culicifacies* [*cf.* **32** 151]. This mosquito appeared to be adversely affected by mean temperatures below

60°F. and humidities below 60 per cent. [*cf.* **18** 195]. The upper limit of temperature at which Indian strains of *Plasmodium vivax* and *P. falciparum* could develop in it was between 90 and 94°F. and the optimum range of temperature for their development was 70–86°F., provided that humidity was favourable for the survival of the mosquito ; a relative humidity of 50 per cent. did not appear to be entirely inhibitory. The lower limiting temperatures for development of the parasites in *A. culicifacies* were not determined, though *P. malariae* was not observed to develop at all at a mean temperature of 59·6°F., whereas oöcysts of *P. vivax* and *P. falciparum* were seen under similar conditions. The extrinsic minimum incubation period varied from 7 days in the case of *P. vivax* at 86°F. to 19 days in that of *P. malariae* at 70°F. The seasonal infectivity of *A. culicifacies* is briefly examined in the light of the experimental findings.

PLANK (H. K.). **Insecticidal Properties of Mamey and other Plants in Puerto Rico.**—*J. econ. Ent.* **37** no. 6 pp. 737–739, 8 refs. Menasha, Wis., 1944.

The results are given of tests on the insecticidal properties of the aerial parts of various plants that occur in Porto Rico. The materials were air-dried in the shade at room temperature, and ground, and most of the experiments were made with dusts against leaf-feeding insects [*R.A.E.*, A **33** 338]. A kerosene extract of finely ground seeds of *Mammea americana* was also examined as a household spray. It was made by soaking 8 oz. of the powder for 24 hours with intermittent agitation in 1 U.S. quart kerosene at room temperature and filtering. Preliminary tests of this extract indicated toxicity to cockroaches, mostly *Periplaneta americana*, L., and *Blattella germanica*, L., ants and undetermined flies and mosquitos. Applied with a small hand sprayer in the open, it acted slowly but allowed little recovery.

HANSENS (E. J.). **Humidity in Relation to the ovicidal Effect of Powders used against the Body Louse.**—*J. econ. Ent.* **37** no. 6 pp. 750–755, 4 refs. Menasha, Wis., 1944.

It was found in the laboratory that the percentages of eggs of *Pediculus humanus humanus*, L. (*P. h. corporis*, Deg.) killed by larvicidal powders varied with the humidity in the incubator during the test. As failure of powders in the practical work might also be connected with humidity, experiments were undertaken to determine the effect of humidity on several that had been found most destructive to eggs of *P. humanus* in routine tests. Eggs were obtained by placing 100 female and 125 male lice on a piece of cloth glued to a metal disk and keeping them at 29°C. [84·2°F.] and about 50 per cent. relative humidity. Each day the lice were removed to fresh cloths and dead ones replaced. Lice were fed twice daily. The tests were made on eggs two and six days old, 20 eggs for each test, in sealed jars containing solutions of salts or sulphuric acid to maintain the desired humidity. The temperature was 30°C. [86°F.], and the period of exposure 21 days. The materials tested included 1 per cent. and 10 per cent. concentrations of phenothioxin, 3,5-dinitro-o-cresyl acetate [numbered with CH_3 as 1], 2,4-dinitroanisole, 2,4-dinitrophenetole, methyl p-amino benzoate, azoxybenzene, 2,4-dinitrophenol, and tertiary butyl valone ; 1 and 5 per cent. concentrations of diethyleneglycol diester of chloracetic acid ; a mixture of 1 per cent. phenothioxin and 1 per cent. 3,5-dinitro-o-cresyl acetate ; and formula MYL (containing 2 per cent. 2,4-dinitroanisole, 0·2 per cent. pyrethrins, 0·25 per cent. Phenol S and 2 per cent. N-isobutylundecyleneamide). All were mixed with pyrophyllite. The results are given in detail. Survival among the older eggs was higher than among the younger ones, probably because of the shorter exposure before

hatching. Mortality was often high at humidities of more than 68 per cent., variable between 60 and 68, and usually not appreciably higher than among untreated eggs at less than 60 per cent. Powders containing 10 per cent. active ingredient gave effective control over a wider range of humidities than those containing 1 per cent. The rise in mortality that occurred with an increase in humidity was not the same with all materials. The 10 per cent. concentration of tertiary butyl valone was the only material effective at all humidities tested (0–80 per cent.). At 80 per cent. relative humidity, MYL, 1 per cent. and 10 per cent. concentrations of dinitro-o-cresyl acetate, dinitroanisole, dinitrophenetole, methyl p-amino benzoate and tertiary butyl valone and a 10 per cent. concentration of 2,4-dinitrophenol had essentially the same toxicity, but at 70 per cent., the 1 per cent. concentrations were no longer toxic and MYL and 10 per cent. concentrations of dinitro-o-cresyl acetate and dinitrophenetole had lost much of their effectiveness. K. Mellanby has found that the humidity beneath the shirt of a man ranges between 23 and 70 per cent. To be effective, an ovicide would have to act between these extremes, and it has been shown that only one did so. It is concluded that before field use is recommended, particularly in a dry climate, a material should be tested at low relative humidities.

STEWART (M. A.). **Rotenone and Ox Warble Control.**—*J. econ. Ent.* **37** no. 6 pp. 756–760, 2 refs. Menasha, Wis., 1944.

For a number of years, it has been possible to effect satisfactory control of *Hypoderma lineatum*, Vill., and *H. bovis*, Deg., on dairy cattle, notably by scrubbing the swellings with a stiff brush dipped in a suspension of 12 oz. derris (5 per cent. rotenone) in 1 U.S. gal. water containing 2 oz. soap [*cf. R.A.E.*, B **30** 10–11]. No satisfactory method of control had been devised for infestations on range cattle, however, and investigations with a view to developing one were carried out in 1941 and 1942 in California, where *H. lineatum* is the only species known to occur. The best results were obtained with a nozzle delivering a flat, fan-shaped spray under a pressure of 250 300 lb. from a distance of about 4 ins. against the grain of the hair. A spray of 10 lb. wettable sulphur, 10 lb. derris (5 per cent. rotenone) and 1 U.S. pint detergent in 100 U.S. gals. water gave satisfactory kill. When the amount of derris was raised to 25 lb., the increase in efficiency did not compensate for the greater cost. When it was lowered to 5 lb., control was not adequate. About 2 U.S. quarts spray was required for an adult animal, and a team of four men could treat about 130 cattle per hour. It is usually necessary to spray three times during the season. Scrubbing dairy cattle with a wash of 1 lb. wettable sulphur, 1 lb. derris (5 per cent. rotenone) and 0·1 U.S. pint detergent in 10 U.S. gals. water did not give control; the greater effectiveness of the spray containing these ingredients at the same concentration is attributed to the penetration obtained by the pressure at which it was applied.

In 1942–43, a powder composed of equal parts by weight of wettable sulphur (325 mesh) and finely ground (200 mesh) derris applied as a dust over warble swellings and gently rubbed into the hair with the palm of the hand was found to be effective only against fifth-instar larvae, and even against these was inferior to a wash of 10 lb. derris in 10 U.S. gals. water with 0·1 U.S. pint detergent. Sprays containing various possible substitutes for rotenone, a list of which is given, were ineffective against *Hypoderma* larvae, as was also a suspension of 12 gm. of a mixture of 20 per cent. DDT [2,2-bis (parachlorphenyl) -1,1,1-trichlorethane], 34 per cent. wettable sulphur, 7·6 per cent. wetting agent and 38·4 per cent. inert filler in 500 cc. water, when 10 cc. was introduced with a syringe from which the needle had been removed into the opening over each larva.

Schoof (H. F.). **Adult Observation Stations to determine Effectiveness of the Control of** *Anopheles quadrimaculatus*.—*J. econ. Ent.* **37** no. 6 pp. 770–779, 1 fig., 7 refs. Menasha, Wis., 1944.

To use adult counts to the best advantage for determining the effectiveness of measures for the control of *Anopheles quadrimaculatus*, Say, it is necessary to choose diurnal resting places that give a true index of the Anopheline population. In this paper, the various types of resting places used as collecting stations over a period of four years in North Carolina are considered comparatively. Either baited or non-baited stations are effective in the immediate neighbourhood of a good breeding area, but the relative value of baited shelters increases with the distance from the breeding areas. Animal shelters are the most satisfactory and reliable baited stations. Cow, horse, pig or goat may be used as bait, but fowls are less satisfactory. Dwellings have the disadvantages that they are often screened, resting places are varied and much time is required for close inspection, and anti-mosquito measures may have been taken. Light, wind and temperature had more significance in non-baited than baited stations. Culverts and bridges are usually less satisfactory than animal shelters but are necessarily near breeding areas, and they show male Anophelines regularly and are easier to inspect thoroughly. Over 50 Anopheline houses (wooden structures, 3×3×6 ft., used as adult stations in or near breeding areas) were employed in the State in 1944, and results indicated that they should be included in control programmes. Breeding conditions were often immediately reflected in them, and breeding was often indicated where larval inspection and animal shelters less than a quarter of a mile away failed to show it. They are considered more reliable indicators of density than nail kegs [*R.A.E.*, B **31** 52] or small boxes on account of their larger size. New Jersey light-traps [**31** 195, etc.] are considered less effective than animal shelters, but are of use where the latter are not available.

Details are given of the way in which the stations are arranged in an area over which control measures are carried out, which comprises the place to be protected and a belt round it one mile wide. Most of the stations are within a quarter of a mile of the protected place, others near heavy breeding areas and one (serving as a control) near a breeding place at least half a mile beyond the limit of operations. Notes are given on the interpretation of adult counts; reduced counts should not be considered indicative of effective control until they have continued for two weeks or more.

Olson (T. A.) & Keegan (H. L.). **The Mosquito collecting Program of the Seventh Service Command for 1942–1943.**—*J. econ. Ent.* **37** no. 6 pp. 780–785, 1 ref. Menasha, Wis., 1944. **New Mosquito Distribution Records from the Seventh Service Command Area.**—*T.c.* pp. 847–848.

In the first paper, lists are given by States of the mosquitos collected as adults or larvae in 1942 and 1943 at 24 stations in eight of the nine States that comprise the seventh Service Command (North Dakota, South Dakota, Nebraska, Iowa, Minnesota, Colorado, Wyoming, Missouri and Kansas). No specimens were received from North Dakota. In 4,882 collections, 79,572 mosquitos were taken, representing 43 species. Notes are given on the breeding places in which larvae were found. Anophelines represented 12·73 per cent. of the total catch in 1942 and 11·54 per cent. in 1943. They comprised *Anopheles quadrimaculatus*, Say, and *A. punctipennis*, Say, from Missouri, Nebraska and Kansas, *A. punctipennis* and *A. walkeri*, Theo., from Iowa and Minnesota, *A. maculipennis* var. *occidentalis*, D. & K., from Minnesota, and *A. barberi*, Coq., from Missouri. Data are included on their prevalence and seasonal and local distribution, and larval habitats and associations where

immature stages were found. The most abundant species were *A. quadrimaculatus*, which was predominant in adult collections, though few larvae were taken, and *A. punctipennis*, which formed 90 per cent. of the larval catch of Anophelines. In 1944, *A. crucians*, Wied., and *A. pseudopunctipennis*, Theo., were collected in Missouri and *A. m. freeborni*, Aitken, in Colorado. Cases of malaria were reported from all States in the Service Command except North Dakota.

The second paper comprises records of localities and dates of collection for seven species from Colorado, three from Iowa, 14 from Kansas, five each from Missouri and Nebraska and one each from South Dakota and Wyoming. Most of the collections were made in 1944, and a few in 1942–43. The Anophelines are *Anopheles maculipennis* var. *occidentalis*, from Colorado, *A. punctipennis* from Colorado and Wyoming, *A. pseudopunctipennis* from Missouri, and *A. quadrimaculatus* from South Dakota.

Zukel (J. W.). **Some Effects of Phenothiazine, Phenothiazone and Thionol on** *Periplaneta americana*.—*J. econ. Ent.* **37** no. 6 pp. 796–808, 87 refs. Menasha, Wis., 1944.

The following is taken from the author's summary of the results of work on the toxic action of phenothiazine, phenothiazone and thionol on *Periplaneta americana*, L. A preliminary account of the effect of phenothiazine has already been noticed [*R.A.E.*, B **31** 33]. Phenothiazine, phenothiazone and thionol are not toxic in the alimentary canal. The lack of toxicity of phenothiazine and phenothiazone is due to the impermeability of the intestinal wall to these compounds. Phenothiazine, phenothiazone and thionol are converted to a compound that gives the reactions for leucothionol during passage through the mid-gut. Phenothiazine and phenothiazone are toxic in contact with the cuticle and when injected into the haemocoele. Thionol is not toxic under the same conditions. The toxic action of phenothiazine and phenothiazone is produced by a leucothionol conjugate formed from the compounds. The conjugate must reach a definite concentration in the haemolymph before the insect succumbs. A sub-lethal concentration produces an uncoordinated walk and the insect recovers as the conjugate is eliminated through the Malpighian tubules. Phenothiazine particles of the smallest size kill the insect in the shortest time with the smallest quantity in contact with the cuticle. The toxic action of phenothiazine and phenothiazone may be due to the inhibition of the respiratory enzyme, cytochrome oxidase.

Searls (E. M.), Fletcher (F. W.) & Kenaga (E. E.). **Methyl Bromide as a Fumigant for Dairy Factories.**—*J. econ. Ent.* **37** no. 6 pp. 822–829, 4 figs., 10 refs. Menasha, Wis., 1944.

As a result of an investigation in Wisconsin on practical methods of fumigating commercial dairy plants with methyl bromide, for the control of various pests [*R.A.E.*, A **33** 343], the quantities per 1,000 cu. ft. recommended for use in cheese factories against *Blattella germanica*, L., are 1, 1¼ and 1½ lb. at 80, 70 and 60°F., respectively, with a fumigation period of eight hours and a circulation period of 30 minutes during which fans are run in the room under fumigation. Smaller dosages at lower temperatures are effective against rats and mice.

Lindquist (A. W.) & Bushland (R. C.). **Toxicity of DDT and Pyrethrum to** *Chaoborus punctipennis*.—*J. econ. Ent.* **37** no. 6 p. 842. Menasha, Wis., 1944.

The results are given of experiments in which larvae and pupae of *Chaoborus punctipennis*, Say, taken from a lake in Florida as overwintering larvae in February 1943, were exposed for 48 hours in batches of 15 in beakers to various

concentrations of 2,2-bis (parachlorphenyl)-1,1,1-trichlorethane (DDT) or pyrethrins in 250 ml. tap water. The lowest concentrations of DDT and pyrethrins that caused complete mortality were 1 part per 75 million and per 100 million, respectively, for larvae and 1 part per 30 million and per 100 million for pupae. These results suggest that DDT is an effective contact insecticide against *C. punctipennis*. With median lethal concentrations of DDT, three or four hours elapsed before the larvae became affected, but toxic dosages of pyrethrins produced almost immediate effect. Both materials caused the moribund larvae to rise to the surface.

Hansen (E. L.), Hansen (J. W.) & Craig (R.). **The Distribution of a Bromine Homologue of DDT in Insect Tissue.**—*J. econ. Ent.* **37** no. 6 p. 853. Menasha, Wis., 1944.

The authors describe investigations in which dibromodiphenyltrichlorethane [2, 2-bis (parabromophenyl)-1, 1, 1-trichlorethane], which behaves similarly to DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] except for a slightly lower toxicity to insects, was prepared from the radioactive isotope of bromine and applied in the form of a saturated solution in cellosolve [ethylene glycol monoethyl ether] to the posterior thoracic tergites of adults of *Periplaneta americana*, L., and larvae of *Tenebroides mauritanicus*, L., *Tenebrio molitor*, L., and *Galleria mellonella*, L., at the rate of about 3·6 mg. for the cockroaches and 0·2–0·3 mg. for the larvae. Within 24 hours all the insects were very torpid or dead ; they were washed in alcohol to remove the compound from the surface and dissected under dilute formalin. Portions of the organs were spread on slides, dried and covered with a celloidon film and then exposed to X-ray film for 250–360 hours. Almost all the tissues could be identified on the exposed film, and there was definite evidence that the compound was present in the nerve cord and brain as well as in other parts of the insect.

Fleck (E. E.). **Rate of Evaporation of DDT.**—*J. econ. Ent.* **37** no. 6 p. 853, 1 ref. Menasha, Wis., 1944.

To determine the rate at which DDT [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] will evaporate from a dusted surface, a glass plate 50 sq. cm. in area with a deposit of 63·36 mg. DDT from a 325-mesh sieve was put in an air bath, for which a four-inch tube was used, and air was passed through at the rate of about 10 litres per hour. The temperature of the bath was kept at 45°C. [113°F.]. The plate was weighed every four days and it was found that the rate of evaporation was 0·34 mg. per day for the first four days and decreased during an observation period of 37 days until it was only 0·05 mg. per day, probably owing to a reduction in the surface area of the dust particles. A total of 4·22 mg. had evaporated by the end of 37 days, when the remainder was found to have a melting point identical with that of the original material. When the rate of air flow was varied from 5 to 20 litres per hour there was no corresponding change in the rate of evaporation. It is concluded that the loss of DDT from insecticidal spray deposits by evaporation will occur too slowly to be of any importance.

Raucourt (M.). **Découverte récente d'un nouvel insecticide l'hexachlorocyclohexane.**—*La Nature* no. 3093 pp. 235–236, 1 ref. Paris, 1945.

The author describes the physical and chemical properties of benzene hexachloride (hexachlorcyclohexane) [*cf. R.A.E.*, B **33** 130], the insecticidal properties of which were first observed in France in 1941, when samples of a

mixture of the four known isomers, prepared by a new commercial method, proved to be very toxic to clothes moths. It is practically non-toxic to man and appears to act as a stomach poison, a contact poison and a fumigant against insects [*cf.* **33** 131]. Tests carried out in 1942–45 showed that it was of value against a number of insects attacking agricultural crops ; that its vapour killed house-flies [*Musca domestica*, L.] ; and that a 3 per cent. dust was highly effective against insects attacking man, such as fleas and lice [*Pediculus humanus*, L.].

HOLLAND (G. P.). **The Distribution of some Plague-important Rodents and Fleas in western Canada (Mammalia : Rodentia, and Insecta : Siphonaptera).**—*Proc. ent. Soc. B.C.* **41** pp. 5–12, 1 fig., 12 refs. Vernon, B.C., 1944.

The investigations that led to the finding of sylvatic plague in ground squirrels (*Citellus richardsoni*) and their fleas in Alberta in 1939 [*cf. R.A.E.*, B **33** 127] are very briefly reviewed, and notes are given on the distribution of eight indigenous rodents and the three introduced rats and 11 indigenous and four introduced species of fleas occurring fairly commonly on them in western Canada (British Columbia, Alberta and Saskatchewan), with reference to their known association, if any, with plague elsewhere [*cf.* **32** 9 ; **33** 88], the host associations of the fleas and the possible dissemination of the disease in Canada. Plague might be introduced by spreading from infected colonies of a native rodent in the United States, as had already occurred in Alberta, or by spreading from infected rats entering the Dominion from ships or by train. Intensive efforts are being made to destroy rats in various towns, and ground squirrels are also being controlled near the known plague foci in Alberta. It is hoped that these measures, and the continued careful surveying of native and introduced rodents and their fleas, will keep sylvatic plague at a level at which it does not affect man.

GREGSON (J. D.) & HOLLAND (G. P.). **Devices for charting and obtaining naturally emerged Cattle Warbles (Diptera : Oestridae).**—*Proc. ent. Soc. B.C.* **41** pp. 31–33, 2 figs., 1 ref. Vernon, B.C., 1944.

Descriptions are given of two devices that facilitate the study of the life history of warble flies [*Hypoderma*] infesting cattle. The first is a measuring stick, consisting of a piece of wood five ft. long, marked with numbers at two-inch intervals, and having a cross bar two ft. long fastened one ft. from the end and marked at two-inch intervals with letters. By placing the long member along the animal's spine and the cross piece even with the projecting pelvis bones, the position of any larva may be expressed by a number and a letter and charted, so that its development can be followed. The second device makes it possible to secure naturally emerged larvae for the study of the stages that develop outside the host. The larvae are trapped in two canvas pouches two feet long and three inches deep, one on each side of the animal. The inner margins are reinforced by $\frac{1}{8}$ in. spring steel rods, which are turned up for three inches at the end, and the outer walls are continued up and tied together over the animal's back. The pockets are closely pressed against the animal by three webbing straps with pieces of elastic inset, which are passed under the belly. The larvae are collected from the pockets daily.

Joint Blowfly Committee. Recent Advances in the Prevention and Treatment of Blowfly Strike in Sheep. Supplement to Report No. 2.—*Bull. Coun. sci. industr. Res. Aust.* no. 174, 20 pp., 10 figs. Melbourne, 1943. [Recd. 1945.]

In this supplement to a report on the prevention and treatment of infestation of sheep by blowflies in Australia [*R.A.E.*, B **29** 1], directions are given

for docking the tails of lambs so as to afford the maximum protection and for performing Mules' operation in its modified form [**32** 142], and notes on the care of the animals after the operations are included. There are also directions for preparing the dressings containing 15 per cent. boric acid known as B.T.B. and B.K.B. [**33** 51, 52]. Experimental data confirming the advantage of the longer tail even in sheep on which the operation has been performed and showing that operated sheep are less susceptible to strike than naturally plain-breeched ones are also given, together with field data on the effectiveness of the operation. Crutching remains essential, but may be carried out only once at mid-season when the animals have been protected by operation.

Recent work on selective breeding to reduce inherent predisposition to strike has shown that a very high percentage of plain-breeched progeny is not always obtained when plain-breeched rams and ewes are mated. Plain-breeched rams varied considerably in the proportion of plain-breeched progeny that any one produced. This proportion was high only if the ram was genotypically plain-breeched. The work also suggested that the percentage of plain-breeched sheep in the second generation was not greater than in the first, provided that non-related animals were mated. It appears that to assure a high percentage of plain-breeched sheep, progeny-tested rams must be used. The bulletin ends with a general summary of recommendations for preventing strike.

Feldman-Muhsam (B.). **A Note on the Conditions of Pupation of *Musca domestica vicina* (Diptera) in Palestine, and its Application.**—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 10–12 pp. 139–140, 2 refs. London, 1944.

In observations on *Musca domestica vicina*, Macq., in Palestine, no evidence was found that the larvae leave a manure heap in which they feed before pupation [*R.A.E.*, B **32** 134]. The climate is such that the surface of fresh manure dries one day after the heap has been made and forms a progressively thickening crust beneath which development and pupation take place, if the heap is not moistened. Larvae reared in the laboratory on fresh cow dung also develop and pupate under the dry crust; if the dung is too dry, they remain small and pupate late if they do so at all. If, however, the dung is too wet, they develop almost normally but escape from the rearing jars when they reach the prepupal stage. The migration takes place only in a dark room or at night. Various types of traps that have been designed to catch larvae as they migrate from a manure pile would be most effective if the manure were moistened when the larvae reached the prepupal stage.

On the basis of these observations, a method of rearing the larvae as food for poultry was devised and is described. Large clay vessels not more than 12 ins. deep are filled with fresh dung, kept a day or two for oviposition in a place where flies are abundant and then transferred to a dark hut. When the larvae are found to have reached the prepupal stage, the dung is thoroughly wetted and the vessel containing it is put in a larger dish. All the larvae migrating from the dung fall into the dish. A chemical analysis of the larvae is given.

Smith (M. G.), Blattner (R. J.) & Heys (F. M.). **Further Isolation of St. Louis Encephalitis Virus; congenital Transfer of Virus in Chicken Mites (*Dermanyssus gallinae*).**—*Proc. Soc. exp. Biol. Med.* **59** no. 2 pp. 136–138, 1 map, 1 ref. New York, N.Y., 1945.

Details are given of further isolations of the virus of St. Louis encephalitis from *Dermanyssus gallinae*, Deg., in Missouri [*cf. R.A.E.*, B **33** 25]. The mites were collected from fowl houses at five places, all within a radius of 11 miles, in St. Louis County, and those from three of them were infected. The virus was also isolated from unfed first-stage nymphs reared from infected

females. The eggs were kept in glass tubes and the larvae, which do not feed, moulted in the tubes in 24–30 hours. It thus appeared that the virus is transmitted through the egg and larva to the nymph. Moreover, members of a colony obtained from mites infected in nature and maintained in the laboratory by feeding on healthy fowls, were found to be still infected after five months' rearing.

WRIGHT (W. H.). **The Bedbug -Its Habits and Life History, and Methods of Control.**—*Publ. Hlth Rep.* Suppl. no. 175, 9 pp., 2 pls., 1 ref. Washington, D.C., 1944.

The adult and the bionomics of *Cimex lectularius*, L., the common bed-bug of the United States and other parts of the temperate zone, are described, brief reference is made to other Cimicids that attack man, and methods of control are reviewed. The only measures recommended as effective where infestations are firmly established are fumigation and superheating. Most of the fumigants that have been found satisfactory are dangerous to use, but good results have been obtained in England with heavy coal-tar naphtha [*R.A.E.*, B **31** 37–39, 144, etc.]. Central heating plant can be used during the summer to eradicate bugs by heat. A temperature of 120–125°F. maintained for several hours gives complete control of all stages. Little damage results to furnishings, but it is advisable to remove delicate musical instruments or lightly veneered furniture.

BHANDARI (B. N.). **Oedema and Scabies in a Famine Hospital.**—*Indian med. Gaz.* **79** no. 12 pp. 574–578, 2 figs. Calcutta, 1944.

During famines in Bengal, 80 per cent. of the very poor suffer from skin troubles and 95 per cent. of these cases are due to infestation by *Sarcoptes* (*Acarus*) *scabiei*, Deg. This high incidence of scabies cannot probably be completely explained by the close personal contact that results from conditions at such times, particularly as half of the nursing and medical staff of a famine hospital recently became infested. It is suggested that dryness of the skin due to the hardness of the water and to deficiency of vitamin A may be partly responsible, as dry skin provides cracks into which the mites can burrow. Almost all the worst cases of scabies were associated with very dry skin.

ROY (D. N.) & GHOSH (S. M.). **On the Possibility of using Oil of Turpentine for the Treatment of Scabies.**—*Indian med. Gaz.* **79** no. 12 pp. 589–590, 2 refs. Calcutta, 1944.

In view of the recent high incidence of scabies in Bengal and the lack of drugs known to be effective for its treatment, possible substitutes were investigated. It was found that oil of turpentine has properties lethal to *Sarcoptes scabiei*, Deg. When a drop of an emulsion made of 20 parts of the oil, 80 parts alcohol and some soap shavings was allowed to trickle down the back of a hand on which female mites had been placed, these were killed in averages of 250, 102 and 80 seconds when the strength of the alcohol used was 50, 70 and 90 per cent. respectively. Under the same conditions, an emulsion of benzyl benzoate at the same concentration with 90 per cent. alcohol and soft soap caused death in an average of 87 seconds. The turpentine was found to reach and kill mites in their burrows without preliminary cleaning of the skin, as benzyl benzoate does [*R.A.E.*, B **30** 145], but neither can penetrate healthy skin. When a female mite was allowed to burrow, external application of either produced no appreciable effect on it within half an hour. No unpleasant reaction to the use of turpentine was observed.

Smith (C. M.) & Goodhue (L. D.). **Increase in Concentration of Insecticide in Freon-12 accompanying Transfer or Discharge of an Aerosol-producing Solution.**—*Industr. Engng Chem.* Anal. Edn. **16** no. 6 pp. 355–357, 3 figs., 3 refs. Easton, Pa., 1944.

One of the problems in the production of insecticidal aerosols is the concentrating effect that occurs in the transfer or discharge of solutions in liquefied gases because of the evaporation of solvent from the solution remaining in the container as liquid is withdrawn from it [*cf. R.A.E.*, B **33** 65]. The authors provide a mathematical treatment for calculating this at any given fixed temperature, and describe experiments by which the validity of the method is confirmed for solutions in dichlordifluoromethane.

Papers noticed by Title only.

Derrick (E. H.). **The Epidemiology of Q Fever** [caused by *Rickettsia burneti* in Queensland].—*J. Hyg.* **43** no. 5 pp. 357–361, 1 fig., 18 refs. Cambridge, 1944. [*Cf. R.A.E.*, B **29** 196; **31** 204, etc.]

Floch (H.) & Abonnenc (E.). **Ixodidés de la Guyane française, I-III.**—*Publ. Inst. Pasteur Guyane* no. 3, 46 pp., 5 pls., 20 refs.; no. 4, 31 pp., 3 pls., 21 refs.; no. 32, 14 pp., 2 pls., 1 fldg. chart, 3 refs. Cayenne, 1940, 1941, 1942. [Recd. 1945.]

Smart (J.). **Notes on Simuliidae (Diptera). II** [including many new names for homonyms].—*Proc. R. ent. Soc. Lond.* (B) **13** pt. 11–12 pp. 131–136, 50 refs. London, 1944.

Menon (M. A. U.). **On a new Species of the Subgenus** *Lophoceratomyia* **Theobald 1905** [*Culex parainfantulus*, sp. n., in Travancore] **(Diptera Culicidae).**—*J. Malar. Inst. India* **5** no. 3 pp. 389–393, 9 figs., 5 refs. Calcutta, 1944.

Shield (G. W.). **Description of the 4th-instar Larvae of** *Aëdes* (*Mucidus*) *grahami* **Theobald (Diptera)** [from Gold Coast].—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 10–12 pp. 129–130, 1 fig., 1 ref. London, 1944.

Burtt (E. D.). **A Note on Variation in living** *Glossina brevipalpis* **Newstead (Diptera), with particular Reference to a red-coloured Form found in Nature** [in Tanganyika].—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 10–12 p. 137, 3 refs. London, 1944.

Coon (B. F.). **Effects of paralytic Insecticides on Heart Pulsations and Blood Circulation in the American Cockroach** [*Periplaneta americana*, L.] **as determined with a fluorescein Indicator.**—*J. econ. Ent.* **37** no. 6 pp. 785–789, 1 fig., 6 refs. Menasha, Wis., 1944. [*Cf. R.A.E.*, B **33** 52.]

Schechter (M. S.) & Haller (H. L.). **Colorimetric Tests for DDT** [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane] **and related Compounds.**—*J. Amer. chem. Soc.* **66** p. 2129, 2 refs. Easton, Pa., 1944.

Schechter (M. S.) & Haller (H. L.). **Colorimetric Determination of 2, 4-Dinitroanisole.**—*Industr. Engng Chem.* Anal. Edn. **16** no. 5 pp. 325–326, 2 graphs, 7 refs. Easton, Pa., 1944. **Colorimetric Determination of 1-Chloro-2, 4-Dinitrobenzene as an Impurity in 2, 4-Dinitroanisole.**—*T.c.* pp. 326–327, 1 graph, 9 refs.

MACKERRAS (I. M.) & MACKERRAS (M. J.). **Sheep Blowfly Investigations. The Attractiveness of Sheep for** *Lucilia cuprina*.—*Bull. Coun. sci. industr. Res. Aust.* no. 181, 44 pp., 2 pls., 20 refs., multigraph. Melbourne, 1944.

In Australia, more sheep are infested by *Lucilia cuprina*, Wied., than by any other blowfly [*R.A.E.*, B **26** 81 ; **30** 30], though it has been found that the larvae of several species can develop in sheep almost equally easily. An investigation was therefore carried out to determine whether sheep are attractive specifically to *L. cuprina* and to examine the conditions that influence their attractiveness. It consisted of observations in the field over several years, closer observation and qualitative experiments on sheep in the insectary, and quantitative experiments along the lines developed by Hobson [**25** 52, etc.].

The following is mainly based on the authors' summary of the results. The field experiments showed that infested sheep, and probably also susceptible but uninfested sheep (those with the breech soiled or moist), were specifically attractive to gravid females of *L. cuprina* [**26** 150] and very much less attractive to flies of other species. The attractiveness of an infested sheep was, however, less than that of fresh carrion, even for the gravid females of *L. cuprina*, and that of a susceptible, but uninfested sheep was still less, while a sheep with a dry fleece and clean, dry breech was apparently not attractive at all. The attractiveness of infested fleece that was removed from the sheep fell off rapidly, but specific attractiveness to gravid females was still exerted over a short distance.

In the insectary, all species were more or less attracted to soiled or wet fleece and fed on it, but *L. cuprina* oviposited on sheep far more readily than any of the other species (*L. sericata*, Mg., *Calliphora* spp. and *Chrysomyia rufifacies*, Macq.). These occasionally laid eggs, and if sufficient moisture was present infestation by larvae developed. Thus, the occurrence of relatively few field infestations by species other than *L. cuprina* may be chiefly attributed to lack of oviposition on sheep and not to failure of the larvae to become established. Oviposition by *L. cuprina* often stimulated *L. sericata* and *C. rufifacies* to oviposit also.

In experiments dealt with in some detail, in which sheep were rendered artificially attractive to flies by Hobson's method [**25** 52] and fleece from the same sheep was exposed in jars, confirmation was obtained with *L. cuprina* of his findings with *L. sericata* that, while the living sheep does not itself stimulate oviposition, it supplies an essential factor for attraction, which is not a tactile stimulus and is not present in effective amount on the freshly shorn fleece. This sheep or *S* factor must be associated with a putrefactive or *P* factor before the sheep becomes sufficiently attractive to stimulate oviposition. The nature of the *S* factor is discussed in some detail [*cf.* **27** 196]. There were indications that it may be no more than particularly favourable conditions for volatilisation by the warmth of the sheep. A series of substances by means of which the attractiveness of sheep could be varied within wide limits was investigated. The most attractive was an alcoholic solution of indole diluted with water, which, when absorbed on cotton-wool plugs, proved more attractive to *L. cuprina* than the soiled, wet breech, but slightly less so than the scouring, and definitely less than the infested breech [**29** 51]. It was more attractive than an aqueous solution of indole. The attractiveness of both was enhanced by the addition of ammonium carbonate [*cf.* **27** 196]. Aqueous solutions of sodium sulphide and ethyl mercaptan [*cf.* **26** 83] were less attractive, and the addition of acetic acid to the alcoholic indole rendered it less attractive even than water [*cf.* **27** 196]. It was shown that the contrary effects of adding ammonium carbonate and acetic acid are not due to pH. In tests made under artificial conditions, three workers using different methods obtained results that were conflicting with those obtained on the living sheep [*cf.* **27** 196]. However, it is considered that the results on the sheep are reliable and

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that the attractants behave in a special way, qualitatively as well as quantitatively, on the living sheep. By the described method of making sheep artificially attractive, small differences in low-grade attractiveness can be demonstrated. This is most useful for the study of bait fractionation. There is no evidence that indole occurs naturally on susceptible sheep.

A method of great promise for testing repellents was devised. A plug soaked in indole solution and tied in the fleece was surrounded by a ring of the substance to be tested. Of 16 substances so tried, Ceylon citronella oil was the most powerful [**29** 50].

It is stated in a concluding discussion that the most important factors influencing oviposition in the insectary experiments were temperature and the fly population. Although some oviposition occurred at 63°F., results were reliable only at or above 70°F. Cold nights not only reduced the activity of the flies during the early part of the day but also retarded the development of the ova. The optimum conditions were maximum day temperatures of 70°F. or higher, and minimum night temperatures of over 60°F. If these conditions were met, oviposition was not affected by absence of direct sunlight or by very low relative humidity. The percentage of gravid females among flies collected from the sheep pen varied from less than 2 to 25 but was usually about 5. Protein food (carrion) was important for egg-laying. Given favourable conditions, the amount of oviposition on sheep or on fleece rendered artificially attractive depended on the number of gravid females per unit area. If this number was high, a combination of *P* and *S* factors was not necessary to stimulate egg-laying ; oviposition occurred on all sheep, and was also induced by the *P* factor alone and even by water alone.

It was also clear that it is not necessary to add any putrefactive factor to sheep to make them attractive. Water alone is sufficient, but only after a lapse of time, indicating that some reaction must take place in the wet fleece, with liberation of volatile substances. *Lucilia* seems unable to perceive a susceptible sheep from a distance, since, under field conditions, some sheep are infested while others, apparently equally susceptible, are not. The fact that oviposition soon occurs on sheep brought into the presence of a sufficiently large number of flies probably explains the common observation that the frequent assembling of sheep for the treatment of infestation leads to an increase in the number infested.

BARTHEL (W. F.). **An Extractor for Use with reduced Pressure.**—*Industr. Engng Chem.* Anal. Edn. **17** no. 1 pp. 53–54, 1 fig., 6 refs. Easton, Pa., 1945.

In the course of work on the preparation of purified pyrethrin concentrates [*cf. R.A.E.*, B **33** 98], it was desirable to know whether any of the newer commercial solvents could be used for the extraction of pyrethrum flowers. As the structure of the pyrethrins is altered and their toxicity to insects greatly reduced when they are heated at temperatures above 100°C. for any length of time and many of these newer solvents have too high a boiling point to be distilled on a steam bath at atmospheric pressure, the extractor described in this paper was designed to permit their use at reduced pressures. It has been used at reduced pressures with many solvents that boil at temperatures between 90 and 125°C. (760 mm.) ; it may also be used satisfactorily under atmospheric conditions when desirable.

[PAVLOVSKIĬ (E. N.), GUTZEVICH (A. V.) & PERFIL'EV (P. P.).] **Павловский (Е. Н.), Гуцевич (А. В.) и Перфильев (П. П.). An Experiment in the Prophylaxis of Sandfly Fever through the Control of the Sandflies.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée Rouge* **8** pp. 23–113, 33 figs., 130 refs. Leningrad, 1937. (With a Summary in German.) [Recd. 1945.]

Sebastopol is a long established endemic focus of sandfly fever [*cf. R.A.E.*, B **19** 125, etc.], and detailed investigations were carried out there in 1932

and 1933 on the control of *Phlebotomus papatasii*, Scop., which is the vector. Work on the transmission of the disease in various countries is reviewed, with special reference to Russia, and information is given on its incidence and the occurrence of species of *Phlebotomus* in the Crimea and other parts of the Russian Union, together with keys to the species that have been found in the Crimea (which comprise *P. papatasii*, *P. major*, Annan., *P. chinensis*, Newst., *P. sergenti*, Parr., *P. alexandri*, Sinton, and *P. perfilievi*, Parr., and an unidentified species of the *minutus* group) and notes on their local distribution, abundance and ecology.

P. papatasii was the dominant species in and near Sebastopol and was closely associated with dwellings and outhouses. The adults appeared in early June, and reached their maximum abundance towards the end of July. This late emergence was thought to indicate that the immature stages and not the adults overwinter. In some places a second, but smaller, peak was observed about the middle of August, indicating the occurrence of a second generation. The incidence of sandfly fever was highest in places where *P. papatasii* was most abundant, and also showed two peaks, one in the second half of July and another about the middle of August. The first cases occurred in June soon after the sandflies appeared, which suggested that the virus was present in them when they emerged [*cf.* **26** 241, etc.]. Several adults of *P. papatasii* were collected from the holes of rats [*cf.* **33** 37] which indicates that these are possible breeding places. Adults were also taken in semi-dark basements, many of which contained remains of stored vegetables, and in ventilation and waste pipes inside the walls of houses. No larvae or pupae were found in numerous samples of material from likely breeding places.

Experiments with stained sandflies [*cf.* **22** 79] showed that they are able to fly over walls and enter inhabited houses, some passing the nearest houses and entering those further away. It is suggested, therefore, that control measures should be carried out over a large area to prevent reinfestation. No sandflies were found on a ship anchored in the bay or on one at a wharf in a part of the town in which they were abundant, and none of the cases of fever among the crews had apparently been contracted on the ships [*cf.* **25** 198].

The control measures were directed against *P. papatasii* and comprised the removal of refuse, manure and human faeces from the yards, stables, sheds, basements and ruins; loosening the soil in potential breeding places and treating it with chloride of lime applied at the rate of 1–3 gals. of a 20 per cent. solution per sq. yard [*cf.* **25** 196]; screening windows; destroying the adults by spraying the corners and cornices of rooms with water, with or without the addition of a disinfectant, or by catching them by means of pieces of board covered with an adhesive [*cf.* **31** 236]; and fumigating with chlorpicrin or pyrethrum powder. The chlorpicrin was applied by heating it in a frying pan. In preliminary experiments in a cellar that was not airtight, in which eggs, larvae and adults in suitable containers were placed at various points, a concentration of 1 oz. per 1,000 cu. ft. killed all adults and larvae in 1½ hours, while one of 0·5 killed adults, larvae and eggs in three hours. Exposure to 1 oz. per 1,000 cu. ft. for six hours killed all the sandflies in a large hospital ward, and after subsequent ventilation for four hours no traces of chlorpicrin could be detected. The pyrethrum was similarly applied by scattering the powder in a frying pan or on a sheet of iron heated over a stove or spirit lamp. All the sandflies in a room that was not airtight were killed by exposure for 4–5 hours to a dosage of 5–6 oz. per 1,000 cu. ft. Pyrethrum smoke-candles [**23** 291] were also effective.

The use of these measures for two consecutive summers did not give consistent results in all parts of the town and its environs, but, on the whole, the abundance of sandflies was considerably reduced and the incidence of sandfly fever decreased. On the basis of the experience obtained, a tentative programme of control is outlined.

[Gutzevich (A. V.).] **Гуцевич (А. В.). *Anopheles hyrcanus* Pall., and its Importance in the Transmission of Malaria in the Far East.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée Rouge* **8** pp. 127–149, 10 figs., 31 refs. Leningrad, 1937. (With a Summary in German.) [Recd. 1945.]

Previous studies on malaria and its vectors in the Russian Far East are briefly reviewed, and an account is given of a survey in June–August 1935 in 12 districts in the eastern half of the area, where *Anopheles hyrcanus*, Pall., was the only Anopheline found [*cf.* *R.A.E.*, B **25** 145]. The larvae were most numerous in standing waters with abundant aquatic vegetation having submerged or floating leaves [*cf.* **21** 6] and a temperature of 18–20°C. [64·4–68°F.]. Such environments occurred at the edges of flood waters overgrown with reeds, in swamps fed by ground water or springs, among filamentous algae in neglected borrow pits, and in small inlets of streams. In one instance, larvae of all instars were abundant in a barrel containing water from a well, though the latter was free from infestation. The larvae were not found in rice-fields or in pools caused by defects in the irrigation system, they were usually absent from waters with a moderate or rapid current and from deep, heavily shaded, cool water, and were not common among dense growths of reeds. In this area, the shallow breeding places do not dry out during the summer because much rain falls in July and August so that the rivers are in flood. On the other hand, heavy rains sometimes kill many of the larvae. Other mosquito larvae found in association with *A. hyrcanus* were *Culex vagans*, Wied., and *C. apicalis*, Adams, which were common, and *Aëdes vexans*, Mg., and *A. cinereus*, Mg., which were rare.

Anopheles hyrcanus overwinters in the adult stage, but the hibernating population is apparently small. In summer, the adults were scarce in houses and more numerous among shrubs, dense grass or vegetation along river banks; they were frequently observed in pigsties. They rarely attacked man. There were apparently two generations a year, of which the first developed in about 25 days. The overwintered females oviposited between 10th and 20th June at a mean air temperature of 12–13°C. [53·6–55·4°F.], and the first larvae hatched in warm shallow water about 23rd June at 13–14°C. [55·4–57·2°F.]; pupation occurred about 10th July and the first adults emerged on 20th July at a mean temperature of 18–19°C. [64·4–66·2°F.]. A slight increase in the numbers of larvae in July was probably due to repeated oviposition by the overwintered females. The date of hatching of the second generation was not ascertained, but a mass emergence of adults probably took place in the second half of August. The weather in autumn is too cold to permit the development of a third generation. The period during which the adults are active and may attack man lasts from about mid-June to mid-September, but they do not become at all numerous until mid-July. The distribution of *A. hyrcanus* in the Russian Far East is limited to the north by the July isotherm of 16°C. [60·8°F.] and its occurrence to the north-west, up the valley of the Amur, is checked by winter cold.

Of 26 females that were allowed to feed on persons harbouring gametocytes of *Plasmodium vivax* (which is the only malaria parasite in the area) and were examined after being kept at 22–23°C. [71·6–73·4°F.] for 8–11 days, two showed oöcysts on the stomach. No sporozoites were present in the salivary glands, probably because they had not had time to develop. The factors responsible for the low incidence of malaria in the area probably include the shortness of the period for which *A. hyrcanus* is active in any numbers and its comparatively infrequent contact with man. It is considered a vector of potential importance, however, and a campaign against malaria in the district is recommended. This should consist primarily of medical treatment, but should also include measures against the mosquito, particularly the elimination or treatment of breeding places. Since *Gambusia* cannot survive the

very severe winters, the use of a local small fish, *Pseudorasbora parva*, is suggested ; it occurs throughout the Amur basin, feeds close to the surface of the water, and has been shown by experiments in northern China to destroy Anopheline larvae readily.

[Gutzevich (A. V.).] **Гуцевич (А. В.). Observations on Blood-sucking Diptera in the Far East.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée Rouge* **8** pp. 151–169, 6 figs., 22 refs. Leningrad, 1937. (With a Summary in German.) [Recd. 1945.]

Blood-sucking Diptera cause much annoyance in the Russian Far East, and a survey to determine the species responsible was carried out from the end of June to mid-August 1935 in 11 districts in the Maritime, Jewish, Ussuri and Khabarovsk Provinces. Collections were made of all examples that settled on the members of the expedition during periods of 20 minutes at various times of the day and night and under various ecological conditions, and these were supplemented by catches in houses and with a net in the open and by rearing adults from pupae taken in nature. The 3,000 examples obtained in these ways represented four families and 39 species of which 11 mosquitos, 11 Tabanids, two Simuliids and the Ceratopogonid, *Culicoides pulicaris*, L., were taken attacking man. Lists are given of the various species with notes on the local distribution, abundance and biology of the more important ones and of each group as a whole. The mosquitos taken on man comprised eight species of *Aëdes* and two of *Culex*, and also *Anopheles hyrcanus*, Pall., which was scarce. The Simuliids and Tabanids, which are active during the day, predominated in the Jewish Province in the west (situated in the valley of the Amur), whereas mosquitos and *Culicoides pulicaris*, which are nocturnal, occurred chiefly in the Province of Ussuri. Most of the activity occurred in the open, and very little indoors ; the only species taken on man in houses were *Aëdes vexans*, Mg., *Anopheles hyrcanus*, and *Culex vagans*, Wied.

Aëdes vexans was more numerous than all the other Diptera together, and was represented by the typical variety and var. *nipponii*, Theo. ; the next in abundance were *Simulium maculatum*, Mg., and *Culicoides pulicaris* which constituted about 15 and 7 per cent. respectively of the insects taken on man. *A. vexans* bred chiefly in small shallow pools in ditches, pits, swampy places and depressions in the soil, which frequently dried out and filled up again after rains and in which aquatic vegetation was absent or sparse. It hibernates in the egg stage, and there are several generations during the season. Mass hatching occurred repeatedly throughout the summer after rains, and adults were always present in abundance. Their typical habitats were shrubs or dense tall grass and they seldom entered houses. Almost all the Simuliids taken on man were *S. maculatum*. Mass breeding occurred in the river Bira (a tributary of the Amur) near the town of Birobidzhan, numerous larvae and pupae of seven species of *Simulium* being found on broken branches in the water and on the submerged leaves and stems of plants growing on the banks, which were mostly covered with forest. The current was fairly rapid, and the temperature of the surface water near the banks was 17°C. [62·6°F.]. No investigations were made on the breeding places of *C. pulicaris*. The Tabanids, of which *Tabanus miser*, Szil., predominated, formed 6 per cent. of the Diptera taken on man, but at the time when these flies were collected (late July and early August) the mass flight was practically over.

The protective measures adopted in the region against blood-sucking Diptera are the use of nets worn on the head and of smoke from fires as a repellent. In field experiments, a considerable amount of protection was obtained by burning a pyrethrum smoke-candle [*cf. R.A.E.*, B **23** 291] in a perforated tin enclosed in a case of perforated fabric held by a tape across the shoulder.

The effectiveness of the candles outdoors can be improved by increasing the amount of potassium nitrate in them to 30–35 parts per 100 parts pyrethrum powder.

A programme of control measures is outlined. It includes filling or oiling the breeding places of *Aëdes* spp., especially in spring, since the generation from the overwintered eggs is the most abundant; the use of oil emulsions against Simuliid larvae [*cf.* **23** 117]; and oiling pools frequented by Tabanids to destroy the adults [*cf.* **17** 154].

[Rubtzov (I. A.).] **Рубцов (И. А.). Investigations on the Use of Mineral Oil Emulsions for the Control of Black Flies.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée Rouge* **8** pp. 171–220, 2 figs., 37 refs. Leningrad, 1937. (With a Summary in English.) [Recd. 1945.]

In addition to a detailed account of experiments in eastern Siberia in 1932 and 1933 on the control of the larvae of *Simulium* spp. by means of oil emulsions [*R.A.E.*, B **23** 117], descriptions are given of others in which an emulsion of carbon bisulphide was tested by the same technique. It contained 68 per cent. by weight of carbon bisulphide, 8 per cent. soap paste and 24 per cent. water. When diluted to a concentration of 0·2 per cent. carbon bisulphide in water at a temperature of 12·3°C. [about 54°F.], it killed 95, 98 and 100 per cent. of larvae in the third and fourth instars after exposures of 4, 8 and 10–15 minutes, respectively. It was observed that the older larvae were more resistant than the younger ones. A solution of carbon bisulphide in water at concentrations of 1 : 700 and 1 : 1,000, which are the highest possible in practice, gave poor results.

Since emulsions of carbon bisulphide are heavier than water they spread well over the bottom of a stream and penetrate under or between stones. They are thus very suitable for use in streams with a pebbly bottom, where Simuliid larvae concentrate. It was considered that to obtain the best results, streams should first be treated with an oil emulsion to kill or dislodge the larvae attached to plants, and then with carbon-bisulphide emulsion, to destroy those that drop to the bottom or occur under stones, and this was confirmed in a field experiment in which the combined treatment was applied to a stream flowing at a rate of a little over a mile an hour in which the water passed at the rate of about 66 gals. per second and had a temperature of 18°C. [64·4°F.]. The amounts used were about 110 gals. oil emulsion, applied from two containers over a period of 10 minutes, and about 33 lb. carbon bisulphide emulsion diluted with an equal quantity of water. A day later, no living larvae were found in a stretch of the stream some 1,100 yds. long.

[Pavlovskiĭ (E. N.) & Skruinnik (A. N.).] **Павловский (Е. Н.) и Скрынник (А. Н.). Observations on the Biology of** *Ornithodorus papillipes*. [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée Rouge* **8** pp. 277–294, 3 figs., 9 refs. Leningrad, 1937. (With a Summary in German.) [Recd. 1945.]

An account is given of investigations on the bionomics of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) carried out in the laboratory in Leningrad in 1935 and 1936, and the results are supplemented from previous work by the authors and compared with data from the literature. Females kept singly with males in September were fertilised, and oviposited for up to seven months after the males had been removed, but only the eggs that were laid during the first three months hatched. Oviposition took place as a rule in autumn or at the beginning of winter; eggs laid abnormally early, for instance in July, did not hatch. In 1935, the first eggs were laid on 15th August and the last on 8th November. The oviposition period lasted 1–10 days or more, and the eggs were deposited singly or in batches, the number per

female ranging from 3 to 60 and averaging 26–27. Some females laid eggs in both years. The egg stage lasted 11–30 days at 15–18°C. [59–64·4°F.]. Most of the eggs hatched at night.

The larvae were fed on guineapigs and engorged in 8–66 minutes. Those that were deprived of food began to die after two months; one survived for 3½ months, but it died in a few days after being fed. When the ticks were fed about 5–10 days after hatching or moulting and were kept at 26°C. [78·8°F.], the subsequent durations of the larval and five nymphal stages were 10–20, 11–18, 15–21, 19–46, 22–47, and 38–105 or more days, respectively. Some individuals became adults after only three nymphal stages (these being chiefly males) and many after only four. Nymphs of the first stage survived starvation for two months (and one for nearly six), and those of the second stage for 2½ months. In previous investigations of the authors, large nymphs survived without food for about six years; adult females allowed to feed were alive after nine years [*cf. R.A.E.*, B **33** 165].

It is concluded that at a constant temperature of 26°C. the development of *O. tholozani* from the egg to the transformation of the whole batch into adults, irrespective of the number of nymphal stages, was completed in 5–9 months; a table is given showing the dates on which various batches developed to the different stages in the life-cycle.

SMITH (C. N.). **The Life History of the Tick** *Ornithodoros coriaceus* **Koch (Argasidae).**—*Ann. ent. Soc. Amer.* **37** no. 3 pp. 325–335, 5 refs. Columbus, Ohio, 1944.

An account is given of the results of prolonged laboratory investigations on the life-history of *Ornithodoros coriaceus*, Koch [*cf. R.A.E.*, B **4** 119]. The ticks were obtained from California and the hosts used were guineapigs and rabbits. The incubation period at various temperatures ranged from 10 to 29 days. Unfed larvae survived for up to five months, and fed examples moulted 4–22 days after dropping from the host. There were 3–7 nymphal stages. First-stage nymphs normally moulted within 11–151 days without feeding, but two that had lived a long time without moulting were induced to feed and these subsequently moulted. In the later stages, moulting never occurred unless preceded by at least one meal. The individual nymphal stages usually lasted a few months, but sometimes well over a year. Some nymphs consistently refused to feed, and others refused some meals but accepted others. Some engorged normally but instead of dropping remained attached to the host, secreting coxal fluid and decreasing in size. These were removed by hand and were able to moult. Others survived for years in one stage and were still alive when the paper was written. The feeding habits of adults of both sexes were very similar to those of nymphs, and some fed as many as five times. Pairing took place off the host after feeding. Data are given on the periods between feeding and pairing, pairing and oviposition, and feeding and oviposition. Females laid as many as 710 eggs in one lot and 1,424 in three lots (the greatest number observed). Some adults survived for several years.

DORSEY (C. K.). **Mosquito Survey Activities at Camp Peary, Virginia.**—*Ann. ent. Soc. Amer.* **37** no. 3 pp. 376–387, 10 refs. Columbus, Ohio, 1944.

Peary Camp is situated in heavily wooded country along a tidal river in eastern Virginia, where salt-marsh and fresh-water breeding areas for mosquitos are extensive. Mosquitos are numerous and annoying at certain seasons, and cases of malaria occur near the camp at these times. A mosquito survey was made from 9th April to 15th November 1943, and species of nine genera were taken. The Anophelines were *Anopheles quadrimaculatus*, Say, *A. punctipennis*, Say, *A. crucians*, Wied., *A. c. bradleyi*, King, and *A. barberi*, Coq.

Data are given on the numbers of adults of various species taken in light-traps, barrels and houses and on man; the numbers of males, females and larvae of each species taken in the different months of the survey; the distribution of larvae in different types of breeding places; and the species associations of the larvae. *Uranotaenia sapphirina*, O.-S., and *Culex erraticus*, D. & K., were often associated with *A. quadrimaculatus*, *C. restuans*, Theo., and *C. apicalis*, Adams, with *A. punctipennis*, and *Aëdes sollicitans*, Wlk., and *A. taeniorhynchus*, Wied., with *Anopheles c. bradleyi*. It is suggested that the presence of larvae commonly associated with those of disease-carrying species, even though the latter are not found at the time, indicates that control measures åre necessary.

Amos (D. W.). **Mosquito Control Training Manual.**—[3+] 43 pp., ill., 9 refs. Suva [the Author], 1944.

This manual includes a key for the identification with a hand lens of the larvae of most of the mosquitos of Fiji, followed by notes on the morphology of the adults and, in some cases, on breeding places and habits. The species dealt with include one recorded as "*Aëdes geoskusea*," of which the adults and larva are briefly described [*cf.* next paper]. It breeds in holes made by lobsters. Other sections deal with the actual or potential importance of Fijian mosquitos as vectors of disease, the equipment required for collecting larvae, laboratory notes and observations on life-history, habits and rearing, and the usefulness of larvivorous fish, which is thought to be considerable in breeding places free from vegetation.

Stone (A.) & Bohart (R. M.). **Studies on Mosquitoes from the Philippine Islands and Australasia (Diptera : Culicidae).**—*Proc. ent. Soc. Wash.* **46** no. 8 pp. 205–225, 14 figs., 27 refs. Washington, D.C., 1944.

Keys based on the adults of both sexes and the male genitalia are given to the mosquitos of the group of *Aëdes kochi*, Dön., followed by notes on morphological characters, habits and distribution. One new species of *Culex* and seven of *Aëdes*, including two of the *kochi* group, are described. Two new subgenera are proposed, *Luzonus* for *Aëdes clavirostris*, sp. n., from Luzon (Philippines) and *Levua* for *A. suvae*, sp. n., from Suva (Fiji). It is stated in a footnote, however, that *A. suvae* is a synonym of *A. geoskusea*, Amos [see preceding abstract], the latter being nomenclatorially valid despite the inadvertent use by Amos of a subgeneric as a specific name.

Zukel (J. W.). **Marking *Anopheles* Mosquitoes with fluorescent Compounds.**—*Science* **102** no. 2641 p. 157, 1 ref. Lancaster, Pa., 1945.

The usual methods of marking Anopheline mosquitos involve individual handling for recognition, but those marked with fluorescent compounds can be detected at once under ultra-violet light. In tests with *Anopheles quadrimaculatus*, Say, the materials used were anthracene, rhodamine B and fluorescein, which give blue, red and green fluorescent colours, respectively. Anthracene can be applied as an aerosol, by vaporising it with heat into a closed chamber, or as a dust mixed with gum arabic. Exposure of caged mosquitos for five minutes to an aerosol concentration of 10 mg. per litre air gives a homogeneous deposit on the exoskeleton without harming the insects. For use as a dust, 1 part anthracene is mixed with 2 parts gum arabic in water and the mixture is evaporated to dryness and ground to powder. Mosquitos dusted with this are then exposed to an atmosphere of saturated humidity for 15 minutes, which causes the particles to deliquesce and adhere to them.

Rhodamine B and water-soluble fluorescein can be used to dye gum arabic at a concentration of 10 mg. dye per 3 gm., and the mixture can be applied in the same way.

HADDOW (A. J.). **On the Mosquitoes of Bwamba County, Uganda : I. Description of Bwamba, with special Reference to Mosquito Ecology.**—*Proc. zool. Soc. Lond.* **115** pt. 1–2 pp. 1–13, 2 maps, 26 refs. London, 1945. **II. Biting Activity with special Reference to the Influence of Microclimate.**—*Bull. ent. Res.* **36** pt. 1 pp. 33–73, 9 figs., 14 refs. London, 1945.

In the first paper, a description is given of the topography, climate and vegetation of Bwamba County, western Uganda, where yellow fever has recently occurred in man [*R.A.E.*, B **31** 61]. It is low-lying and extensively wooded. It includes part of the edge of the Ituri Forest and is shown to belong faunistically to the Lower Guinea Forest District of the Guinea Forest Province. In a discussion of the zoogeography of the Ethiopian mosquitos [**29** 115], Edwards suggested that 38 are probably confined to the Guinea Forest Province ; of these 18 have been found in Bwamba. The ecology of *Aëdes aegypti*, L., and *Anopheles gambiae*, Giles, in Bwamba is discussed with reference to the literature on their habits elsewhere, and the possible relationship of their behaviour to the general ecology of mosquitos in forest areas is considered. While larvae of *Aëdes aegypti* occurred in domestic receptacles, they have been found more often, both by the author and others in Bwamba, in tree-holes [*cf.* **31** 61], sometimes in virgin rain forest and sometimes 800 yards from the nearest dwelling. They were also found in plant axils near dwellings. *A. aegypti* was very rarely represented among catches of adults taken while biting, and it is concluded that it is mainly a sylvan species in Bwamba and that it must be essentially zoophilous. Larvae of *Anopheles gambiae* were abundant in ground pools, in the forest and outside it, but adults were not very plentiful. However, they are known to occur in many areas within the main forest, and are obviously essentially zoophilous in this region. They are mainly night-biters in Bwamba as elsewhere, but were found to feed at most times during the day in the forest.

The second paper deals with the intensive study of the mosquitos of the area that was begun in 1942. The results of comparative observations on the relative humidity, saturation deficiency, temperature and light intensity in the rain forest, in a banana plantation, and an open compound are discussed. It was found that the forest was cooler and moister by day than the plantation and the latter cooler and moister than the open compound. The three environments had very similar climates at night, however, with high and stable humidity, and slowly falling temperature.

Mosquitos were taken in special 24-hour catches and in large-scale routine captures made in connection with an attempt to isolate the virus of yellow fever from forest forms. Both methods are described and the catches are discussed in detail. Baited trap nets were tried at night, as the use of lights would have given false results, but they were found to be less efficient than hand catching. Among the mosquitos taken were 32 species, as well as four groups of species and undetermined members of the genus *Culex*. The experimental catches showed that females of *Aëdes simpsoni*, Theo., the only species known to be infected with yellow fever in Bwamba [**31** 61], feed mainly in coffee gardens, maize fields and the thinner parts and edges of banana plantations, occur in small numbers within the edges of the primeval rain forest, and are scarce in fully exposed situations. They preferred human blood to that of fowls, goats and monkeys, which attracted them in that order, and tests with naked children showed that they attacked the head and shoulders in preference to other parts of the body regardless of posture, and preferred standing to sitting and sitting to lying baits. Many forest mosquitos occurred

also in banana plantations. All the species of *Anopheles* taken, with one unimportant exception, and most of those of *Aëdes* were more plentiful in forest than plantation, but *A. simpsoni* was much more abundant in the plantation. Analysis of day and night catches showed that all species of *Anopheles* are mainly nocturnal, while most species of *Aëdes* feed principally by day. It also suggested that mosquitos migrate into plantations from the forest by night when the microclimate of the two habitats is similar. This finding is thought to have a bearing on the epidemiology of yellow fever. *A. simpsoni*, which occurs mainly in and around native plantations near huts, has been shown to enter the rain forest and bite there. It could therefore obtain the virus from infected animals, if such exist, and transmit it to man, and other species may be able to spread the infection in the same way. Analysis by four-hour groups (which correspond best with the successive climatic phases of the day and night) of 15 catches in forest and 15 in banana plantations, each catch lasting 24 hours, showed that there are two types of biting cycle. In the first, there is one main peak of activity in 24 hours and this may occur either by night or, usually in the case of forest species, by day. In the second, two peaks occur within 24 hours, usually about sunset and sunrise; in the case of diurnal species such as *A. simpsoni*, they are in the morning and late afternoon [*cf.* **32** 185]. It is suggested that these cycles depend on features of the microclimate, and the biting behaviour of the main species is discussed from this point of view.

WEBB (J. E.). **On the Respiratory Mechanism of *Melophagus ovinus* L. (Dipt.).** —*Proc. zool. Soc. Lond.* **115** pt. 1-2 pp. 218–250, 5 pls., 21 figs., 5 graphs, 21 refs. London, 1945. **The Penetration of Derris through the Spiracles and Cuticle of *Melophagus ovinus*, L.**—*Bull. ent. Res.* **36** pt. 1 pp. 15–22, 1 fig., 3 graphs, 16 refs. London, 1945.

The following is taken from the author's summaries. In the first paper, an account is given of the morphology of the respiratory system of *Melophagus ovinus*, L., the respiratory movements of the abdomen in each sex are described, the function of the respiratory system is discussed, and the probable respiratory mechanism is deduced from the morphological data. Experiments in which the rate of entry of ground derris root into the tracheal system was used as a measure of the rate of breathing showed that mechanical ventilation of the tracheal system normally takes place. Respiratory movements of the abdomen produce a directed flow of air passing in through the abdominal spiracles and out through the thoracic spiracles. Experiments with both derris and inert dusts showed that at high rates of respiration, the amount of dust entering the tracheal system is governed by the structure of the spiracle, the particle size of the dust and the volume of air inspired in a given time. At low rates of respiration, the number of spiracles operating is of importance. The abdominal spiracles afford greater protection against the entry of dust into the tracheal system than the thoracic spiracles.

It is shown in the second paper that in *M. ovinus*, derris dust is absorbed through the spiracles and tracheal system [*cf. R.A.E.*, B **32** 226]. The amount of dust entering the tracheae is governed by the structure of the inspiratory spiracles and the rate of flow of the inspired air. Factors stimulating the rate of respiration (increased muscular activity, the presence of 5 per cent. carbon dioxide, and a rise in temperature from 20 to 30°C. [68 to 86°F.]) increased the rate of entry of derris into the body. Derris penetrated the external cuticle slowly at 30°C. but not at all at 20°C. [*cf.* **32** 227]. It is postulated that the entry of derris through the cuticle probably depends on the hardness of the lipoid layer.

Busvine (J. R.). **Some Pioneer Work on Protection against Body Lice by the Use of lasting Insecticides.**—*Bull. ent. Res.* **36** pt. 1 pp. 23–32, 1 fig., 12 refs. London, 1945.

The work described was carried out in 1940–42, and was designed to find a material lethal to lice [*Pediculus humanus*, L.] and innocuous to man, that was stable and lasting if applied to undergarments next to the skin and would give continuous protection from infestation for several weeks. It demonstrated the possibility of obtaining such protection and also led to the development of new methods of controlling the head louse [*P. h. capitis*, Deg.] [*R.A.E.*, B **30** 99]. The methods and materials here put on record have since been improved or superseded to some extent. In the laboratory tests, various insecticides, chiefly thiocyanates and pyrethrins diluted in mineral oils, were sprayed directly on to the lice or used to spray or impregnate fabrics on which the lice were then placed. From the results of the direct spraying tests, it is concluded that the aliphatic thiocyanates show a sudden drop in toxicity to lice in the higher members of the series, and the lowest members are also especially toxic to mammals. Lauryl (dodecyl) thiocyanate seemed to be the best compromise between toxicity to insects and safety to man [*cf.* **27** 251]. Of the more complex thiocyanates, butyl carbitol thiocyanate (β-butoxy-β′-thiocyanodiethylether) with an equal amount of refined kerosene (Lethane 384) was much more toxic to lice than was thiocyanoethyl laurate with an equal amount of refined kerosene (Lethane 60) but it is also more toxic to mammals. Lethane 384 special (12·5 per cent. butyl carbitol thiocyanate, 37·5 per cent. thiocyanoethyl laurate and 50 per cent. refined kerosene) was a good compromise. Dixanthogen (bis-ethyl xanthogen), which has been used on a large scale in Russia [**31** 227], was about as toxic as lauryl thiocyanate. Benzyl benzoate was not very toxic. The toxicity of pyrethrins was increased tenfold by admixture with 2 per cent. isobutylundecyleneamide. Lasting qualities were tested on flannel or calico by spraying it with insecticide or impregnating it with the insecticide in a volatile solvent. More insecticide was needed if the second method was adopted, and the impregnation of a whole garment at the adequate rates would be too costly in insecticide and might be toxic to the wearer. As lice wander about considerably among the underwear [**32** 190] and thiocyanates have little or no repellent effect on them, it appeared that treating strips of the undergarments, especially the seams, might be of value.

Field trials, the procedure of which is described, were carried out on naturally infested tramps. Results with pyrethrum were disappointing. Of the thiocyanates, Lethane 384 was the most rapid in action, but was not very lasting and occasionally caused skin irritation, while 50 per cent. lauryl thiocyanate in oil was very lasting. Accordingly a mixture of 1 part Lethane 384 and 3 parts 50 per cent. lauryl thiocyanate was tried and gave very promising results. When shirt or vest was sprayed with 8 cc. and pants with 5 cc., infestation was reduced by about 99 per cent. for at least a month. The undergarments of infested vagrants in a large air-raid shelter were sprayed with Lethane 384 special on an extensive scale during months of heavy air raids, and this treatment resulted in the elimination of lice. As, however, the lasting effect of thiocyanates is lost if treated garments are washed, a special belt was devised to be worn next to the skin. It was six inches wide and made of calico woven so that the surface was puckered into small pleats very attractive to the lice, and was impregnated with 8 cc. Lethane 384 special. These belts caused a considerable and sustained reduction in infestation, and would be valuable as supplements to the other measures adopted in a general campaign against lice. They were popular among the men. Lethane 384 and to a smaller extent Lethane 384 special and lauryl thiocyanate cause a severe burning sensation accompanied by erythema if the wearer is sweating freely.

THEODOR (O. H.) & PARSONS (B. T.). **Insectary Rearing of** *Anopheles pharoensis*.—*Bull. ent. Res.* **36** pt. 1 pp. 79–83. London, 1945.

A cage colony of *Anopheles pharoensis*, Theo., was established between September and November 1943 from larvae collected in various breeding places near Cairo and maintained for three generations until the end of January 1944, after which it died out on account of the low temperature of the insectary. The cage was like the small one described by Hackett [*R.A.E.*, B **28** 85] with slight modifications. It was made of wood with glass observation windows, the upper halves of the sides were covered with mosquito netting, and humidity was maintained by wet blankets over the sides and front. There were sleeves for the introduction of the mosquitos and the host animal, if any. A rabbit was first used, but the mosquitos were reluctant to feed on it, so human blood was provided by putting the forearm into the cage. The reaction of various people to the bites is discussed. Sugar solution also was provided on a sponge suspended from the roof of the cage. Swarming was induced by turning on a blue light over the cage for several hours in the evening [*cf. loc. cit.*], but sometimes began at dusk before the light was switched on. It ceased rapidly if a white light was substituted for the blue. It was not very active when the population of the cage was 40–50, but began immediately when 260 mosquitos were introduced. Eggs were laid in dishes containing river water, a preference being shown for water containing filamentous algae. The number of eggs per batch varied from 60 to 150. The incubation period was 3–4 days in November at the mean temperature of 21°C. [69·8°F.], and the percentage hatch was 70. Larvae completed development in water containing powdered biscuit, but not in water containing algae alone or with baker's yeast. The addition of yeast to biscuit did not increase the percentage of larvae that pupated, but shortened the duration of the larval stage. Yeast is a valuable food for the first-instar larvae. As long as powdered biscuit was used, no difference was noticed between development in water containing algae or Nile mud. A description is given of the rearing procedure finally adopted, in which first-instar larvae were fed on yeast and those of the subsequent instars on biscuit. As a protection from dust storms, dishes were covered with lids supported to allow the circulation of air. At constant night temperatures of 23 and 27°C. [73·4 and 80·6°F.] and variable day temperatures, the larval stage lasted about 23 and 18 days, respectively. The pupal stage lasted 3–4 days at 20°C. [68°F.]. From the beginning of November to the beginning of January, 200–300 adults emerged every week.

MULLIN-DÍAZ (E.). **Las especies de** *Anopheles* **del Uruguay.**—*Comun. zool. Mus. Hist. nat. Montevideo* **1** no. 3, 8 pp., 1 map, 14 figs., 6 refs. Montevideo, 1943. [Recd. 1945.]

The species of *Anopheles* known to occur in Uruguay are *A. annulipalpis*, Arrib., *A. maculipes*, Theo., *A. pseudomaculipes*, Theo., *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., and a species called by the author *A. tarsimaculatus*, Goeldi [*cf. R.A.E.*, B **32** 91, etc.] A key to the adults is given, but it is pointed out that the characters used to distinguish certain species, including *A. maculipes* and *A. pseudomaculipes* [which are commonly considered synonymous] are very variable. The first five were recorded for the first time from Uruguay in 1927 and 1928 by Gaminara & Talice [*cf.* **17** 51], and the presence of the first four was confirmed by the author in recent investigations, in the course of which the species called *A. tarsimaculatus* was also found in four departments. *A. albitarsis* seemed to be the most abundant. Anopheline foci were located in all the ten departments in which searches were made, but only in rural surroundings. The females fed for preference on animals, but *A. annulipalpis* and *A. albitarsis* will survive and oviposit in captivity when

fed on human blood. In some districts, mosquitos, including *A. albitarsis* and *A. annulipalpis*, were parasitised by mites.

COUCH (J. N.). **Revision of the Genus *Coelomomyces*, parasitic in Insect Larvae.**—*J. Elisha Mitchell sci. Soc.* **61** no. 1–2 pp. 124–136, 2 pls., 23 refs. Chapel Hill, N.C., 1945.

The hitherto known fungi of the genus *Coelomomyces* comprise five described species, four parasitic in larvae, and sometimes in adults, of mosquitos [*R.A.E.*, B **27** 65 ; **30** 183, etc.] and one found in *Notonecta* [**16** 83], while unidentified species have been recorded from mosquito larvae in Northern Rhodesia [**33** 117] and Malaya. The literature on them is reviewed, the genus is redescribed, a new family is proposed for it, and five new species, all from mosquito larvae in Georgia (U.S.A.), are described. These are *C. dodgei* from *Anopheles crucians*, Wied., *A. quadrimaculatus*, Say, and *A. punctipennis*, Say, *C. quadrangulata* from *Anopheles* sp., *C. psorophorae* from *Psorophora ciliata*, F., *C. uranotaeniae* from *Uranotaenia sapphirina*, O.-S., and *C. pentangulata* from *Culex erraticus*, D. & K.

LEE (D. J.) & WOODHILL (A. R.). **The Anopheline Mosquitoes of the Australasian Region.**—*Monogr. Dep. Zool. Univ. Sydney* no. 2, xii+209 pp., 34 pls., 8 maps, 13 figs., 4½ pp. refs. Sydney, 1944.

The introductory sections of this monograph include information on the history of the study of Anopheline mosquitos in the Australian region and the classification, morphology, bionomics and control of Anophelines. Keys are given to the adults, fourth-instar larvae and eggs, if known, of the species of *Anopheles* and *Bironella* occurring in the Australasian region (including Australia, New Zealand and islands eastward to 180° longitude and northward to the equator, and bounded to the north-west by a line round the western coasts of the Moluccas, Ceram and Timor). The greater part of the book consists of descriptions, sometimes quoted or translated from the work of other authors, of the adults of both sexes and larvae (or such of these forms as are known) of the species occurring in the region, together with notes on their distribution, biology and relation to disease. The species that are known to occur in the region but only on the islands west of New Guinea are dealt with more briefly. The work is intended to serve as a basic one, to which revisions can be added as an increase in knowledge makes this desirable.

GUNTHER (C. E. M.). **Practical Malaria Control. A Handbook for Field Workers.**—8×5 ins., 91 pp. New York, N.Y., Philos. Libr., 1944.

This handbook is based on the author's practical experience in New Guinea and is intended for those who, with only an academic knowledge of the disease, have to deal with malaria in the field in undeveloped districts with scattered populations. In addition to chapters on the diagnosis and treatment of the disease and its complications, there is one on preventive measures, in which short notes are given on measures to be taken to check malaria among the indigenous population and the way to lay out a small station with a compound for native servants and labourers, together with data on the use of prophylactic drugs, precautions against mosquitos under settled and camp conditions, the collection and packing of mosquito specimens for identification, and the control of Anopheline larvae in permanent, semi-permanent and temporary breeding places.

CHANDLER (A. C.). **Introduction to Parasitology with special Reference to the Parasites of Man.**—7th edn. (revd.), 8½×5½ ins., x+716 pp., 309 figs., refs. New York, N.Y., J. Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1944. Price $5.

This is a revised edition of the book formerly published under the title "Introduction to Human Parasitology" [*R.A.E.*, B **24** 253, etc.]. It has again been completely re-written, though there have been no extensive changes in arrangement since the sixth edition when the scope was widened to include notes on the chief parasites of domestic animals and lists of references were appended to each chapter. The three main sections deal with Protozoa (together with spirochaetes, rickettsiae and their allies and viruses), helminths and Arthropods; the section on Arthropods includes some simple keys to important families, genera or species. Stress is placed on life history, epidemiology, interrelations of parasite and host and the principles of treatment and prevention of infestation or infection rather than taxonomy and morphology.

SERGENT (Ed.) & BÉGUET (M.). **Conclusions pratiques à tirer d'une expérience d'épouillage par poudrage insecticide faite à Maison-Carrée et l'Arba (Algérie).**—*Arch. Inst. Pasteur Algérie* **22** no. 2 pp. 109–112. Algiers, 1944.

Experiments on the control of lice [*Pediculus humanus*, L.] with dusts were made between June 1943 and January 1944 in a prison near Algiers and in and near a village some 19 miles away. The dusts used were MYL [which contains pyrethrins, 2,4-dinitroanisole, N-isobutylundecyleneamide and Phenol S in pyrophyllite (*cf. R.A.E.*, B **33** 107)] and a dust of which the active ingredient was DDT [2,2-bis (parachlorphenyl)-1,1,1-trichlorethane] and of which only a small quantity was available. In the experiments at the prison, the subjects were undressed and the dust was spread by hand on both sides of their clothes and blankets. Daily counts showed that lice always disappeared progressively after a single application of DDT or two applications of MYL, and an individual was generally free from lice in 18 days. In spite of the favourable conditions for control, reinfestation occurred as a result of the entry of new arrivals and because some of the treated persons worked outside the prison.

Treatment under natural conditions was studied in the village and among the scattered population of its surroundings. Only MYL was used. Dusting clothes on the wearer was shown to be effective. Because of this and because it had no harmful effect on the clothes and was effective against fleas, the method was favourably received by the villagers. It is concluded from the results of both experiments that the dusts provide a very simple method of treatment, and that their action lasts for a considerable time. They are suitable for treating the members of a family in which cases of typhus have occurred, and if necessary whole populations, and they can be used for mats, bedclothes, etc. in houses that may harbour typhus. They are also highly suitable for use by those engaged in fighting a typhus epidemic, who, even if vaccinated, may be carriers of infected lice. General, simultaneous delousing of the population of a region does not, however, prevent reinfestation for long in Algeria, because the people often move about over long distances, come into close contact at markets, etc., and have no desire to avoid infestation by lice.

MARTIN (R.). **Sur la pathogénie de la paralysie ascendante à tiques.**—*Arch. Inst. Pasteur Algérie* **22** no. 2 pp. 125–130. Algiers, 1944.

Tick paralysis occurs principally in Australia, North America, South Africa and central Europe. It is caused by about a dozen species of Ixodids, and one case has been recorded in which the causal agents were larvae of an Argasid [*R.A.E.*, B **25** 3]. However, Argasid larvae resemble Ixodids in that they remain fixed on the host for a long time. The paralysis is commonly believed

to be attributable to a toxic principle in the tick [*cf.* **32** 80], but such a principle would be unlikely to occur in some individuals only of a number of species in four continents and to affect young animals and children exclusively. Were it associated with any particular physiological state of the tick, paralysis would occur much more frequently than it does. Moreover, the theory fails to account for the rapid recovery that follows removal of the tick. The author suggests that the determining factor is in the host, not in the tick. He has observed cases of reflex epilepsy in guineapigs infested with Mallophaga, and a case in man caused by adult Argasids, which remain attached only for the period of feeding, has been recorded by Schaeffer. This reflex epilepsy is interpreted as the clinical sign of a central vasoconstriction following a cutaneous stimulus. It is suggested that tick paralysis is the clinical manifestation of a reflex central vasodilatation following the comparable but different stimulus provided by a tick that remains attached for a considerable time. This would explain the fact that only young animals and children are affected and the rapid recovery that follows removal of the tick.

COLLIGNON (E.). **La campagne antipaludique de 1943 dans le département d'Alger.**—*Arch. Inst. Pasteur Algérie* **22** no. 2 pp. 131–140, 4 refs. Algiers, 1944.

The main object of the anti-malaria campaign in the department of Algiers in 1943 [*cf. R.A.E.*, B **32** 144] was the protection of the troops stationed in various parts of the department, particularly the malarious region near the coast. In spite of the scarcity of drugs and the presence of many non-immune persons in contact with others who had been infected previously, the measures carried out (training, intermittent flushing of water courses and stocking of pools with *Gambusia holbrooki*) in conjunction with a low population of *Anopheles maculipennis*, Mg., following scanty rainfall in winter and spring and the drying up of spring breeding places, resulted in malaria being confined to local outbreaks that died out quickly in early autumn when heavy rain flushed the breeding places. In the mountains, larvae of *A. claviger*, Mg. (*bifurcatus*, auct.) and *A. marteri*, Sen. & Prun., were found in association throughout the summer and in the early autumn.

ATIQUR RAHMAN ANSARI. **Mallophaga found on domestic Fowl,** *Gallus domesticus* **Linn., in the Punjab.**—*Indian J. Ent.* **5** pt. 1–2 pp. 129–142, 9 figs. New Delhi, 1944.

The Mallophaga known to infest fowls in the Punjab are *Menopon gallinae*, L., *Eomenacanthus stramineus*, Nitzsch, *Gallipeurus heterographus*, Nitzsch, *Goniodes dissimilis*, Nitzsch, *Goniocotes gigas*, Tasch., *G. gallinae*, Retz. (*hologaster*, Nitzsch), *Lipeurus caponis*, L., and *L. tropicalis*, Peters, which is recorded from India for the first time. A key to these species is given, followed by brief notes on their morphology and prevalence and a detailed account of the measurements and life history of *Gallipeurus heterographus*, a widely distributed and common species, which was studied in the laboratory. One adult survived off the host for 85 days at 39°C. [102·2°F.], but the usual time was 40 days. The females had a preoviposition period of 2–3 days and laid 14–26 eggs in 15–20 days. About 20–25 per cent. of the eggs of paired females and all of those of unmated ones were infertile. The average durations of the egg stage and three nymphal instars were 6, 7, 10 and 14 days, respectively. Breeding continues throughout the year, but the life-cycle is shorter in summer than winter. This louse is numerous enough between March and June to be a pest.

Attention is drawn to the importance of cleanliness, light, ventilation and the provision of dust baths for the prevention of infestation by lice. New birds should be segregated for at least two weeks and treated twice before they are turned out with other birds, and special attention should be paid to breeding

fowls. Brief directions are given for dipping and dusting fowls to free them from infestation; any treatment should be applied twice at a week's interval. Dusts are not very effective but are useful in winter when dipping is unsafe. A commercial product containing 90 per cent. sodium fluoride is employed in the Punjab. It is mixed with an equal quantity of country tobacco snuff for application by hand, and the mixture is further diluted with four parts road dust or ashes for dusting from a can or bag, which is about twice as costly as hand application. For dipping, a solution of 1 oz. sodium fluoride per gallon water is used and the cost is less than one-third of that of hand application. Sodium fluosilicate may be substituted for sodium fluoride and is even more effective. Tobacco refuse ground to a dust may also be employed. One part is mixed with five parts ashes or road dust for dry application, and a stock dipping solution is prepared with one part tobacco refuse, ten parts water and a little soap and diluted for use to 6–8 times its volume with water. This gives a high degree of control. An effective dust bath is made by half filling a box or pit with fine dry soil, over which is put a thick layer of ashes, and covering this with a mixture of tobacco-refuse dust and ashes (1 : 3).

Qutubuddin (M.). **A Report on the Sandflies of Hyderabad-Deccan (City) with a short Note on a new Species.**—*Indian J. Ent.* **5** pt. 1–2 pp. 207–211, 27 refs. New Delhi, 1944.

A survey of the sandflies of the city of Hyderabad was begun in November 1942 on account of the occurrence of oriental sore [caused by *Leishmania tropica*] in some districts of Hyderabad State. The species represented among the 2,444 individuals collected during the first five months were *Phlebotomus papatasii*, Scop. (the commonest and most widely distributed), *P. argentipes*, Ann. & Brun., *P. colabaensis*, Young & Chalam, *P. shortti*, Adl. & Thdr., *P. bailyi*, Sinton, type form and var. *campester*, Sinton, *P. antennatus*, Newst., *P. dentatus*, Sinton, *P. eadithae*, Sinton, and an undescribed species of the subgenus *Sintonius* on which morphological data are included. Notes are given on the method of collecting and identifying specimens and on the prevalence and sometimes the local distribution of the various species.

Wood (R. C.) & Dixon (K. C.). **Tick-borne Relapsing Fever in Cyprus.**—*Brit. med. J.* no. 4424 pp. 526–528, 1 fig. London, 1945.

Details are given of 12 cases of relapsing fever that occurred in Cyprus in 1942 among troops who had passed the night in or near caves some of which were later found to harbour *Ornithodoros tholozani*, Lab. & Mégn., a known vector of the disease in other parts of the Levant. The presumed incubation period usually lasted 8–10 days, but varied from two days to five weeks. The junior author later infected guineapigs with blood from a further case contracted in the island, which substantiates the view that the disease is tick-borne, but the spirochaete was identified as *Spirochaeta hispanica* and not *S. persica*, of which *O. tholozani* is a natural vector. Neither the tick nor the disease was previously known to occur in Cyprus.

[Pavlovskiĭ (E. N.).] Павловский (Е. Н.). **Tick-borne Relapsing Fever in Manguishlak.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 11–23, 3 figs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

[Grebel'skiĭ (S. G.).] Гребельский (С. Г.). **Faunistic and ecological Observations in the Deserts of the Manguishlak Peninsula.** [*In Russian.*]—*T.c.* pp. 199–227, 16 figs., 26 refs. (With a Summary in English.)

It is stated in the first paper that since species of *Ornithodoros* that transmit relapsing fever can exist independently of man or domestic animals [*cf. R.A.E.*,

B **31** 162], a survey for naturally infected ticks of this genus was made in the summer of 1936 in the sparsely populated semi-desert peninsula of Manguishlak, in south-western Kazakstan.

Larvae, nymphs and adults of a species close to *O. tartakovskyi*, Olenev, were frequently found in burrows of tortoises, hedgehogs and a gerbille (*Rhombomys opimus*), and some of the ticks from burrows of the gerbille in the depth of the desert transmitted spirochaetes to guineapigs and mice when allowed to feed on them in the laboratory in Leningrad. The incubation period lasted 5–10 and 5–11 days, respectively, but few spirochaetes appeared in the blood and the infection usually lasted only 7–13 days in mice and 19–29 days in guineapigs, which distinguishes this strain from those transmitted by *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.). The ticks attached themselves to two men while they were being collected from the gerbille burrows and transmitted relapsing fever to one of them after having been allowed to feed on him again. These ticks from Manguishlak represent the fourth species of *Ornithodoros* to transmit spirochaetes in the subtropical zone of the Russian Union [*cf.* **31** 59], and they were found further from human habitations than in any similar survey.

In the second paper, the author describes the climate, topography and faunistic character of the peninsular and states that various insects were collected there in the course of the investigations, in addition to ticks. These included unidentified fleas from the burrows of rodents, mosquitos of six species, which were rare owing to the general scarcity of water but included *Anopheles maculipennis*, Mg., in one place near the sea, and the sandflies, *Phlebotomus grekovi*, Khod., *P. caucasicus*, Marz., *P. alexandri*, Sinton, *P. sergenti*, Parr., *P. papatasii*, Scop., and *P. minutus*, Rond., in that order of decreasing abundance. The distribution of the sandflies was very uneven; they occurred in the burrows of rodents, which are described in some detail, caves and ruins, but not in native summer tents. The prevalent strong winds would prevent them from spreading much beyond these sheltered habitats. *P. papatasii* was found only at one point, which was in the desert far from any possible contact with man.

[Pavlovskiĭ (E. N.) & Skruinnik (A. N.).] **Павловский (Е. Н.) и Скрынник (А. Н.). Experimental Investigation on the Transmission of the Tick-borne Relapsing Fever in the Course of the Metamorphosis of *Ornithodorus papillipes* and under other Conditions.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 25–42, 10 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

The number of nymphal stages in *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) varies from 3 to 5 even among individuals that hatch from the same batch of eggs. An account is given of investigations in the laboratory in Leningrad with larvae, nymphs and adults to ascertain in which stages of its life-cycle this tick can acquire and subsequently transmit spirochaetes of relapsing fever. The ticks were fed in batches on infected guineapigs and then on healthy ones, and the results showed that they can acquire the infection in any of the active stages of their development and transmit it in any of the subsequent stages, negative results with fifth-stage nymphs being attributed to the small number used. Transembryonic transmission of the spirochaetes [*cf. R.A.E.*, B **33** 165] was not obtained, since none of 418 larvae from eggs laid by infected females and 295 first-stage nymphs resulting from them proved infective. It was also shown that infection can be transmitted by the bite of a single nymph or adult, that ticks can sometimes feed on an infected guineapig without acquiring infection, and that ticks sometimes infect guineapigs before and after a feed in which they fail to do so. Experiments in which the ticks were removed from the host before they had time to engorge showed

that feeding for 1½–2 minutes is sufficient for transmission, and that when feeding is interrupted, a single nymph can infect three guineapigs in succession.

[Skruinnik (A. N.).] **Скрынник (А. Н.). Contribution to the Biology of the Tick** *Ornithodorus verrucosus*. [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 43–50, 5 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

An account is given of laboratory observations in Leningrad in 1936 and 1937 on the bionomics of *Ornithodoros verrucosus*, Olen., Zas. & Fen. Pairing was observed, and as in the case of *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.), oviposition was seasonal [*cf. R.A.E.*, B **33** 186], occurring between 1st July and 13th October. The eggs, which were not numerous, hatched in 16–32 days at room temperature (15–18°C. [59–64·4°F.]). The ticks were kept at 26°C. [78·8°F.] and were allowed to engorge on guineapigs 5–10 days after hatching or moulting. Some passed through four nymphal stages, but most through only three. The durations of the larval stage and the four nymphal stages after feeding were 10–15, 13–17, 15–24, 18–46 and 45–90 days, respectively, except that some individuals remained in the third nymphal instar for up to three months. Ticks kept in the laboratory were still living after four years, and some that were naturally infected with relapsing-fever spirochaetes continued to infect guineapigs throughout that period. Larvae and nymphs that were the offspring of a batch known to include infected adults failed to transmit infection. Unlike other workers [*cf.* **23** 178], the author and her collaborators did not find the bites of *O. verrucosus* painful. Instances of starved ticks feeding on engorged ones were observed.

[Serdyukova (G. V.).] **Сердюкова (Г. В.). Experimental Tick-borne Relapsing Fever in the Jackal** (*Canis aureus* **L.).** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 51–57, 1 fig., 22 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

It has been shown that spirochaetes of Central Asiatic relapsing fever can be transmitted by *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) to hedgehogs (*Erinaceus europaeus*) and wild rodents, and natural infection has been found in dogs. In experiments by the author in 1937, a six-months-old jackal (*Canis aureus*) taken in Tadzhikistan, became infected with a strain of *Spirochaeta persica* (*sogdiana*) pathogenic to man following a single meal by five infected examples of *O. tholozani* from a cave near Stalinabad (Tadzhikistan). Spirochaetes appeared in the peripheral blood seven days after the meal and were present in varying numbers for 13 days. The jackal remained apparently healthy during the 45 days of the observations, and subinoculation of its blood into two guineapigs failed to infect them.

[Moskvin (I. A.).] **Москвин (И. А.). The Effect of chemical Irritants on the Ticks** *Ornithodorus papillipes*. [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 59–78, 4 figs., 16 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

In Central Asia, tick-borne relapsing fever is too restricted in distribution and incidence to be of much importance, but it is widely spread among the troops posted along the frontier in the Pamirs, and eradication of the tick vectors is difficult, since they live in the mud walls of native buildings or in the burrows of rodents, where fumigants are ineffective. Laboratory experiments were therefore carried out in Leningrad to find repellents that could be used to impregnate underclothes or bedding in camps.

In all, 26 substances were tested against nymphs and adults of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) by means of an olfactometer, which

is described. Notes are given on their physical and chemical properties, and their effect on the ticks is discussed and shown in tables. The most effective, which retained much of their effectiveness when diluted, were turpentine, an infusion of the leaves of mint (*Mentha piperita* and *M. crispa*), wood tar (specific gravity 1·057–1·085), ortho- and meta-chlorphenol, acetic acid and Malinin's fluid (a mixture of kerosene, carbolic acid, cinnamon oil and an infusion of pyrethrum flowers in turpentine). No differences in reaction were observed between the adults and the nymphs or between ticks that had last fed one or five months before being tested. The results with the most effective repellents were confirmed by exposing the ticks to them in small covered clay pots and counting the numbers that crawled out through openings in the bottom.

[Moskvin (I. A.).] **Москвин (И. А.). The Effect of Chlorine, Chlorpicrin and Sulphur Dioxide on the Ticks** *Ornithodorus papillipes* **under Laboratory Conditions.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 79–92, 4 figs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

With a view to controlling *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) in native dwellings in the Pamir plateau, laboratory experiments were carried out in Leningrad to determine the minimum concentrations of chlorine, chlorpicrin and sulphur dioxide in air that would kill nymphs and adults of this tick embedded in loess. The technique employed is described, and details are given of typical experiments, showing the percentages of mortality in 24 hours of ticks at different depths in the loess. The results showed that the minimum concentrations that gave complete mortality down to a depth of 10 ins. were 1·5 per cent. for chlorine and 3 per cent. for sulphur dioxide (2 per cent. under humid conditions). Chlorpicrin was effective only at concentrations that were 100 times as great as that lethal to man, and even then it acted more as a repellent. When ticks alone were exposed to chlorpicrin, the lethal dosage was half that in the presence of loess. Loess adsorbed most of the chlorpicrin applied, and since it retained it for a long time, this fumigant is unsuitable for use in native buildings constructed of this material, where no artificial ventilation is provided.

[Moskvin (I. A.).] **Москвин (И. А.). The Action of Chlorpicrin, Chlorine, Sulphur Dioxide and some Repellents on the Ticks** *Ornithodorus papillipes* **in their Biotopes.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 93–103, 3 figs., 8 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

The effectiveness against *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) of fumigation with chlorine, sulphur dioxide and chlorpicrin [*cf.* preceding abstract], was tested in June 1937 under natural conditions in and near a town in the western Pamirs, where this tick and *O. lahorensis*, Neum., are abundant in dwellings and animal quarters constructed of stone, timber and a mixture of clay and loess. The local inhabitants have become immune from the effects of tick bites, but the cattle and sheep suffer severely from September till spring, when they are confined to the sheds. The eight huts and four sheds chosen for treatment with chlorpicrin were made as air-tight as possible, and small muslin bags containing ticks were inserted at different depths into the walls, ceiling and floor. The fumigant was poured on to pans placed on hot sand and the exposure lasted 1–3 days. Concentrations of 3 and 4 fl. oz. per 100 cu. ft. gave complete mortality in two of the huts, but were not so effective in the others and still less so in the sheds, the thin walls and roofs of which proved permeable. Increasing the humidity in some of the huts by evaporating water in them before the treatment somewhat increased mortality. Other conditions being

equal, mortality was highest among ticks placed on the floor or in the lower part of the walls. The huts could not be re-inhabited until 6–10 days after fumigation, and as in one instance the vapours were still evident on the tenth day as soon as the door and windows were shut and the hut was heated, it is suggested that fumigation should be carried out only in summer.

The available quantities of chlorine and sulphur dioxide were insufficient for conclusive results, but concentrations two or three times as high as those effective in the laboratory [see preceding abstract] gave less than 50 per cent. mortality.

Protection from tick bites at night was obtained by spraying the underclothes and bedding with mint water each evening, or by wetting the bed-clothes and sleeping bags with a 10 per cent. emulsion of pine tar and applying undiluted tar to the earthern floor of the hut and the legs of the bed.

[Belous (I. A.).] **Белоус (И. А.). Loess and its sorbtive Properties.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 237–250, 5 figs., 11 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

In view of the possibility of controlling *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) in houses and animal quarters in the western Pamirs by fumigation [*cf.* preceding abstract], experiments were carried out on the adsorptive properties of loess, of which these buildings are largely constructed. It was found that the loess expands in the presence of moisture and shrinks under dry conditions, which leads to the formation of cracks in the walls and ceiling and interferes with fumigation, and that its adsorptive properties are due to the presence of colloidal particles. In tests with chlorpicrin, chlorine and sulphur dioxide, adsorption was reduced by first saturating the loess with steam, and when this was done complete mortality of ticks was given in the laboratory by chlorpicrin at the low concentration of 2 fl. oz. per 100 cu. ft. of air.

In experiments in buildings, wastage of chlorpicrin was avoided by slow evaporation of the fumigant and by first releasing steam until the relative humidity reached 90–100 per cent. The percentage mortality obtained in dwellings was variable, but averaged 77, with a maximum of 100, in three in which steam was released and 71, with a maximum of 89, in three in which it was not. The period of exposure to the fumigant was 24 hours in each case, and the concentration applied about 2 fl. oz. per 100 cu. ft. Fumigation with chlorine and sulphur dioxide gave unsatisfactory results.

[Pavlovskiĭ (E. N.) & Shteĭn (A. K.).] **Павловский (Е. Н.) и Штейн (А. К.). The Reaction of the Skin of Man to the Bite of *Ornithodorus*—Vectors of Tick-borne Relapsing Fever in the Caucasus and Iran.** [*In Russian.*]—*Trav. Acad. milit. Méd. Kiroff Armée rouge* **18** pp. 251–255. Leningrad, 1939. (With a Summary in English.) [Recd. 1945.]

Detailed descriptions are given of the effect on the human skin of the bites of adults and nymphs of *Ornithodoros verrucosus*, Olen., Zas. & Fen., collected in Georgia and North Caucasus, and of examples of a species of *Ornithodoros* close to *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.), but larger, that were taken near Teheran (Persia). Since these ticks have been shown to be vectors of relapsing fever [*cf. R.A.E.*, B **24** 174; **26** 8], it is suggested that a knowledge of the changes in the skin caused by their bites may be of assistance in diagnosing tick-borne relapsing fever.

EDDEY (L. G.). **Spray-killing of Mosquitoes in Houses. A Contribution to Malaria Control on the Gold Coast.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 3 pp. 167–188, 1 map, 2 figs., 7 refs. London, 1944.

An account is given of an extensive campaign for killing mosquitos in native houses, carried out from November 1942 to November 1943 at Takoradi in the Gold Coast Colony, to protect from malaria, which is hyperendemic there, the large numbers of European Service personnel that had arrived in 1941. Direct relationships between rainfall and total mosquito kills and between rainfall and Anopheline predominance are demonstrated. *Anopheles gambiae*, Giles, the chief local vector, was the most abundant Anopheline throughout the period. *A. funestus*, Giles, also a vector, was recorded occasionally and other Anophelines only very rarely. Dissection of 100 females of *A. gambiae*, chosen at random during July, revealed an infection rate of 3 per cent.

The treatments applied, which varied at different times and in different parts of the area with the availability of supplies, were sprays of cresol and kerosene (1 oz. to 1 gal.) and pyrethrum and kerosene ($\frac{1}{2}$ lb. to 1 gal. with double extraction effected over a total period of 48 hours), a pyrethrum aerosol (released from dispensers containing pyrethrum insecticide dissolved in freon [dichlordifluoromethane]) and pyrethrum as a dust. The methods of application and costs are compared in detail; applications were made twice weekly, and mosquitos were swept up from the floor fifteen minutes after the treatment was applied. Pyrethrum aerosol was shown to be the most desirable insecticide, with pyrethrum and kerosene also effective and next best in order of labour economy. Pyrethrum dust was effective but unsuitable on account of the high cost of the heavy application required and limitation of supplies. The costs, including materials and labour, of applying the three other treatments to a given community are analysed in terms of house, room and population units. Pyrethrum aerosol was the most costly and pyrethrum and kerosene the least.

The reduction in the total morbidity rate and malaria incidence among European Service personnel stationed in the areas where houses were treated exceeded that in other parts of the Gold Coast, although 1943 was exceptionally wet at Takoradi. This is accepted as evidence of the value of killing adult Anophelines in conjunction with other control measures. In May and June, monthly kills increased by 870 per cent., and 67,000 Anophelines were destroyed in houses of Takoradi township during June, but there was no commensurate increase in malaria rate. Little evidence is available as to the effect of the combined control measures on the non-European population, but the trends of malaria indices in infants indicated some benefit from the destruction of adult mosquitos. It is shown also that the keeping of comprehensive statistics on adult kills provides a useful supplement to catching-station records for indicating the efficiency of control measures, and that wide differences in mosquito density can occur in similar, adjacent rooms. It is concluded that the effects of large-scale destruction of mosquitos in houses, though difficult to assess, are considerable and it should form an integral part of any emergency anti-malarial measures undertaken.

HOLDEN (J. R.) & FINDLAY (G. M.). **Pyrethrum as a Tsetse Fly Repellent: Human Experiments.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 3 pp. 199–204, 1 ref. London, 1944.

Details are given of field experiments carried out in the dry season in the Gold Coast to determine whether an anti-mosquito preparation consisting of pyrethrum in a vanishing-cream base, which had given encouraging results in preliminary laboratory tests, would prevent tsetse flies from biting man [*cf. R.A.E.*, B **32** 68]. The predominant species was *Glossina palpalis*, R.-D.

The cream was smeared on the legs, arms, trunk and neck of Africans, who sat motionless in dappled light and shade beside a stream wearing only shorts. It prevented all biting for six hours when no strenuous exercise had been taken between treatment and exposure, and only one bite near the sole of the foot on one or two men occurred when exposure was during the seventh hour after treatment (the longest period tested), but the flies were not prevented from settling on the skin. All except one of the tsetses that settled on controls bit. When heavy sweating was brought on by work in strong sunlight between treatment and exposure, the cream lost its protective power. Two supplementary experiments carried out in April 1944 indicated that the determining factor, at any rate in the case of man, is sweating rather than sunlight. The experiments are to be repeated during the wet season. It was observed in incidental tests that the pyrethrum ointment gives considerable protection against *Culicoides* sp. on man and *Hippobosca* sp. on cattle.

BUXTON (P. A.). **Rough Notes : *Anopheles* Mosquitoes and Malaria in Arabia.** —*Trans. R. Soc. trop. Med. Hyg.* **38** no. 3 pp. 205–214, 21 refs. London, 1944.

The information in this paper is compiled partly from published data and largely from unpublished reports. Malaria is very serious in small, well-defined areas of the Red Sea coastal belt where there is water. Where it occurs and water is scarce, it is presumed that the vector breeds in shallow brackish wells and possibly in subterranean cisterns. *Anopheles gambiae*, Giles, is present in the southern part of the belt and is probably responsible for much malaria. Farsan and the other islands in the Red Sea are nearly waterless and probably free from the disease. In the hills behind the coastal belt, it seems likely that all the fertile valleys running westwards from the mountains are malarious. *A. gambiae* has been recorded from two localities and is probably widely distributed. The peninsula of Aden is not likely to provide many breeding places for Anophelines as much of it is very steep, the soil is porous, the rainfall is low and the inhabited parts appear to be under careful sanitary control. Locally-acquired malaria seems to be quite rare, though it is known to occur occasionally. The low ground is mostly desert, but there are large and populous oases watered by springs, and some of the valleys hold water after rain has fallen in the hills. Many people live near the water, so malaria is often severe though localised. Floods sometimes occur on the north side of Aden harbour, cultivators block the stream for irrigation, and water remains in borrow pits for months. Larvae of *A. culicifacies*, Giles, are abundant and *A. gambiae* is also found. Malaria is attributed mainly to *A. culicifacies* var. *adenensis*, Christ., which is common. Control measures directed against it in one area where it was breeding in fresh-water wells in gardens and potteries and in irrigation channels, some of them very saline, were successful. Malaria appears to be serious and widespread in the Western Aden Protectorate, where *A. gambiae* has been collected in many places, and in the Yemen. There is little doubt that the " oasis fever " of central Arabia is malaria, and several settlements have been completely deserted on account of it. With regard to the north-east coast, there is a detailed report from Bahrein [*R.A.E.*, B **27** 153], where malaria is common owing to the many types of fresh water on the island, and several species of *Anopheles*, especially *A. stephensi*, List., are abundant. It is stated in a report of the Bahrein Petroleum Company that screening has been found effective. Of the females of *A. stephensi* collected in houses and dissected, 0·5 per cent. were infected with *Plasmodium*, the rate rising to just over 2 per cent. in the transmission season. Both *P. vivax* and *P. falciparum* appeared to be common along the coast of Al Hasa, and malaria seems to be widely distributed inland. In 1916, Gill found " fever " extremely common in Muscat throughout the year [*cf.* **4** 173].

A list is given of 15 Anophelines known to the author to have been recorded from Arabia, showing the localities in which they have been found. Two he considers misidentifications, but the occurrence of the remainder is well established. Two doubtful records based on larval determinations only are also given. No species has ever been collected from the interior of Arabia, and no dissection has been done except at Bahrein. It is suggested that *A. gambiae* is the principal vector of malaria in western Arabia, and that its importance in southern Arabia, where it breeds in pools in stream beds, has not been sufficiently realised. *A. culicifacies*, which breeds in fresh or salt water in open agricultural wells and in channels in gardens, is regarded as the vector in and around Aden. *A. stephensi* is doubtless an important carrier in the north-east. It might be feasible to exterminate Anophelines from some of the more isolated oases and wadis; reinfestation of the areas would be extremely unlikely.

LEWIS (D. J.). **Observations of *Anopheles gambiae* and other Mosquitoes at Wadi Halfa.**—*Trans. R. Soc. trop. Med. Hyg.* **38** no. 3 pp. 215–229, 1 map, 2 figs., 22 refs. London, 1944.

Wadi Halfa is an important communications centre on the Nile a short distance south of the boundary between Egypt and the Anglo-Egyptian Sudan. *Anopheles gambiae*, Giles, was first identified in the district in May 1941 [*R.A.E.*, B **31** 88], but had probably been there for many years. Locally-acquired malaria occurred in the town in 1925, and mosquito control was begun in 1932. *A. gambiae* has recently been found in central Egypt, and very thorough measures are necessary at Wadi Halfa to prevent it from spreading northwards and invading new areas or adding to the difficulty of control in those in which it already exists. If it can be eradicated from Egypt, Wadi Halfa may serve as a barrier confining it to the south. The area discussed, which extends for about 36 miles along the Nile from the southern end of the Second Cataract to Faras on the frontier, is described with particular reference to climate and surface water. The Nile flows between steep banks of alluvium, and there are several large islands and sandbanks on which numerous pools are formed at low water. In a few places, pools also form in depressions in sedge-covered mud banks exposed at low water. When the river is unusually high, water pours over the banks and produces small temporary swamps. The level is highest in September and lowest in June. Much of the riverside plain is irrigated by pumps. An abortive scheme to irrigate some of the low land between river and desert some years ago resulted in brackish pools being left. If the level of the Aswan Reservoir is raised, as is possible, swampy conditions will probably be extended.

Eight species of mosquitos, including three Anophelines, were found in the area in 1942; all are common to the Ethiopian and Palaearctic Regions, the fauna of which mingle at Wadi Halfa. *A. gambiae* was the only Anopheline seen by the author in the area between June 1942 and December 1943, except at Faras 20 miles from Wadi Halfa. It is estimated from biological studies elsewhere that *A. gambiae* can develop from egg to adult in seven days in summer at Wadi Halfa, but may take a month or more in winter. From observations in 1942 and 1943, it appears that no breeding takes place from about mid-December to mid-April, presumably because pools do not exist for long enough. As it is improbable that the adults could live for four months in the dry desert air, it is supposed that the species dies out annually north of Wadi Halfa and overwinters near the Second Cataract. Breeding increases greatly in May, when the falling river leaves many pools, but is curtailed in July by the rising flood, though it continues, to a limited extent, on irrigated land, where water sinks rapidly into the porous soil. Probably in the past, *A. gambiae* flew northwards each year for a few miles from the Cataract in May and June, bred in the residual pools south of Wadi Halfa and moved northwards in increasing numbers until, at the flood season, some five generations had been completed.

Small fish are too numerous in the shallow water at the river's edge for many larvae to reach Wadi Halfa by drifting, and cars and boats that could carry adults are few. Many larvae of *A. multicolor*, Camb., were found in saline water in the canal at Faras West in 1942 and in pools in 1943, and a dark specimen of *A. pharoensis*, Theo., resembling Egyptian rather than Sudan specimens, was bred from a larva in the Faras canal in June 1942. Very brief notes are given on the breeding places of the other five mosquitos recorded.

As control of *A. gambiae* is designed to minimise the risks of its reaching Egypt, eradication was aimed at. The area is suitable for this as most of the periphery is desert, the winters are cold, there is no rainy season to provide breeding places when the river pools are covered by flood water and the prevailing wind blows towards the main possible source of reinfestation. Oiling, dusting with 1 per cent. Paris green in Nile silt and filling and draining were used for river pools and cultivated land. *Gambusia holbrooki* was a great success in the Faras canal, as there were no predatory birds, and predatory fish did not have access. It flourished in a pool containing 0·66 per cent. chlorine [*cf.* **22** 158] and in addition 0·63 per cent. sulphate. From April 1943, control was concentrated on a stretch of river a little less than four miles long (the southern end 2½ miles south of Wadi Halfa railway station) and adjacent cultivated land, though inspections were continued throughout the area. It was hoped that this stretch would form an effective barrier. An outbreak of malaria occurred in an uncontrolled rural area at the end of April, and *A. gambiae* was found in many pools there and elsewhere south of the barrier, but it was reported in only four of the numerous similar untreated pools north of the controlled area in the following ten months. During the flood season, the river rose to an unusually high level, but no larvae appeared in the numerous pools south of the town. It is thought that this was probably due to the control measures. The barrier was to be extended into the Cataract in 1944. All aircraft from the south are sprayed at the three aerodromes in the Khartoum area and trains from the south are sprayed at Wadi Halfa. Steamers from Egypt are sprayed in transit. *A. gambiae* has become so rare in the Wadi Halfa area that it is unlikely to travel northwards by aircraft, steamer or sailing boat, but steamers are sprayed as a precaution.

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ERRATA.

Page 22 line 8 for " dibutyl " read " dimethyl "

,, 125 line 24 for " *Danubiosimilium* " read " *Danubiosimulium* "